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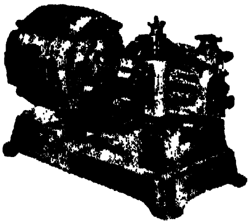

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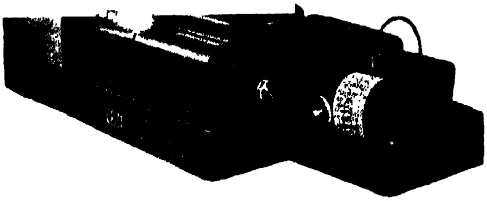

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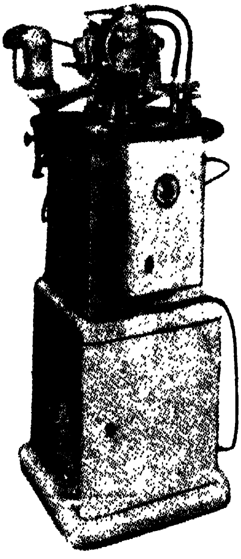

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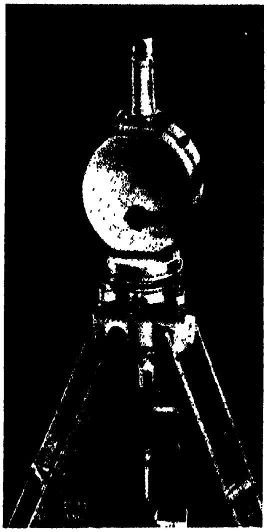

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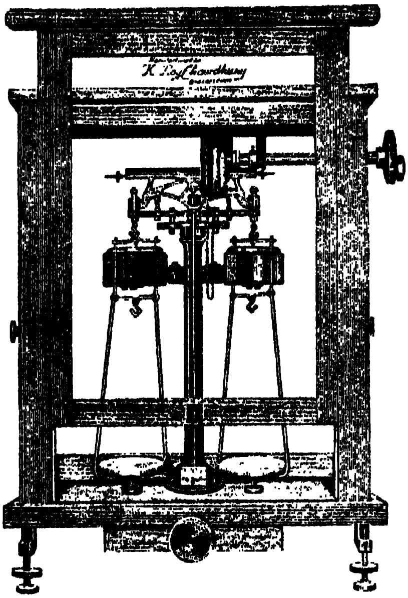

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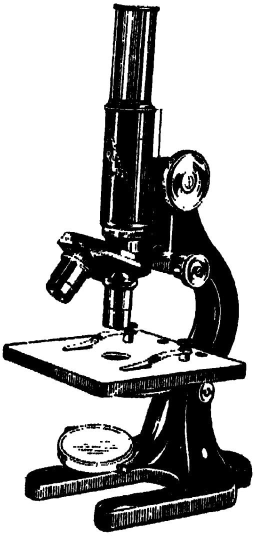

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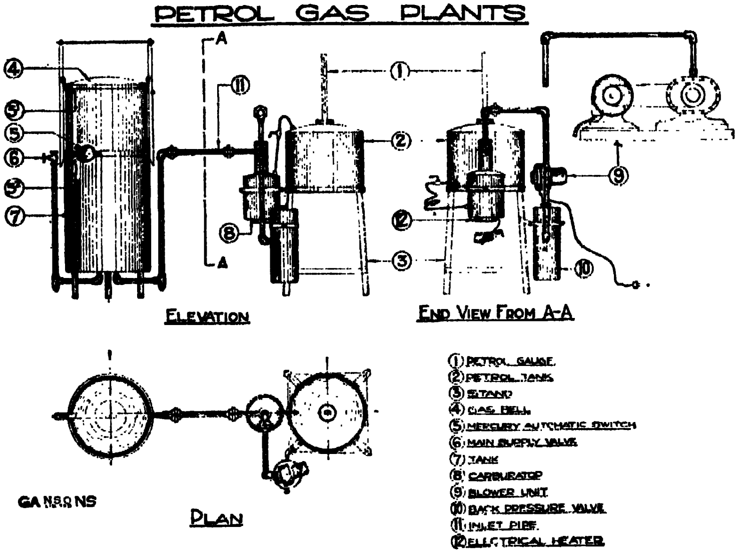

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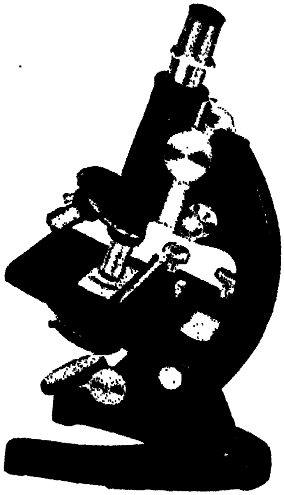

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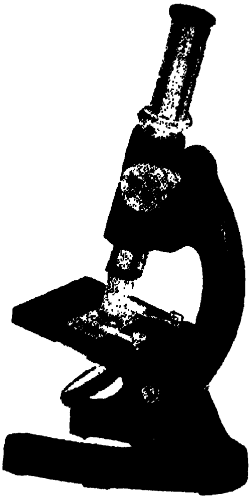

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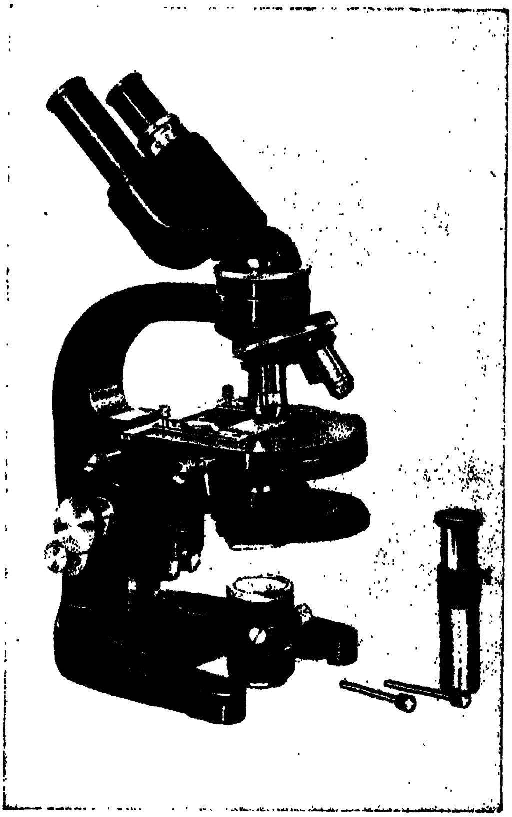

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During this period of over a decade, Calcutta has made great strides in the field of educational, scientific, technological and industrial development. New institutions have sprung up and those which already existed have considerably developed and expanded their activities in various branches of research and learning. While previous volumes on Calcutta were undoubtedly of great help, it was found necessary to plan and prepare the present volume as an entirely new effort. In comparison with earlier volumes, greater emphasis has been placed on the scientific institutions—fundamental, medical, agricultural, and engineering, the Government surveys and scientific establishments and on learned societies, specially scientific, and less on the city's historical, social and cultural aspects. Every endeavour has been made to include at least the important, if not all, scientific institutions. It is likely that some important institutions have still escaped inclusion either because notes on them were not received or were received too late for incorporation, for which the Editor offers his apology.

Our thanks are due to a large number of contributors, whose co-operation has been mainly responsible for the successful preparation of the volume. We express our thanks to the Chairman, Calcutta Improvement Trust, for his kindly preparing for the volume a map of Calcutta showing bus and tram routes. Our thanks are specially due to Sir Paul Benthal for his kindly arranging supply of half the quantity of paper required free of charge.

EDITOR

January 1, 1952
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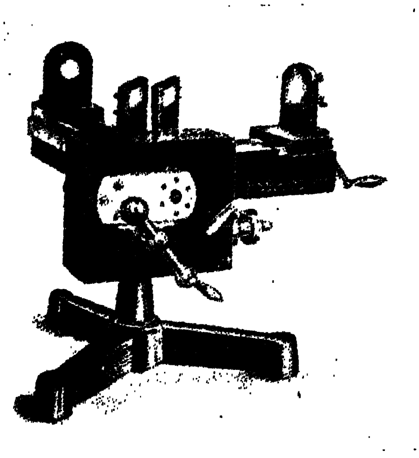

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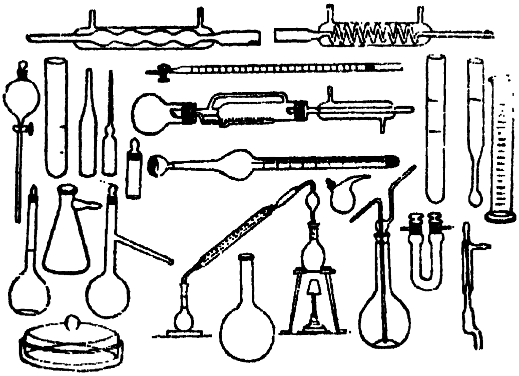

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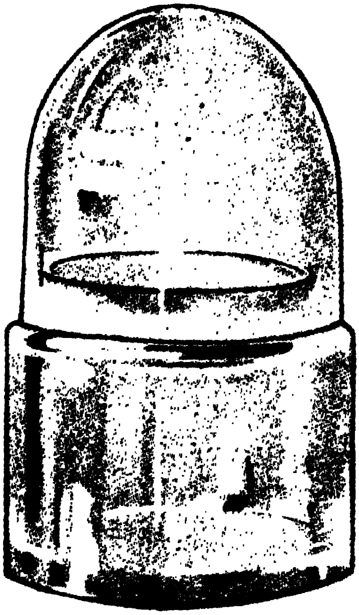

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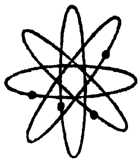
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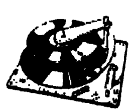
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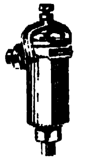
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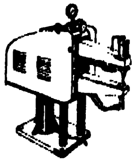
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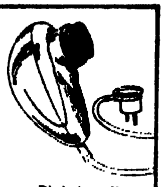
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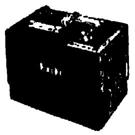
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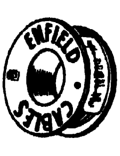
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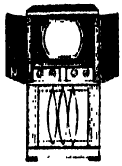
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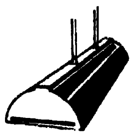
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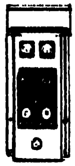
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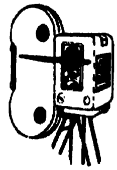
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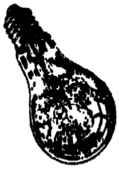
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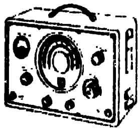
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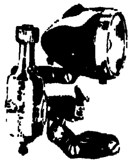
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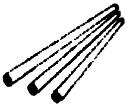
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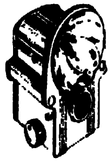
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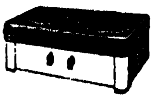
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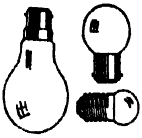
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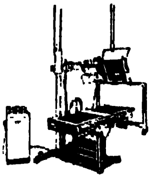
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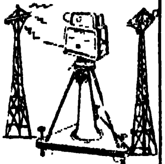
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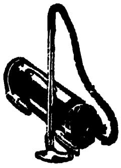
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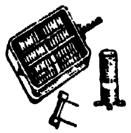
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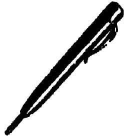
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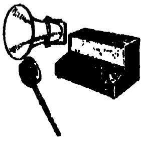
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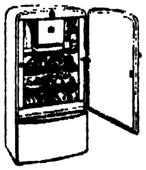
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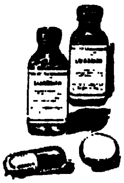
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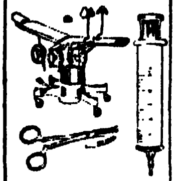
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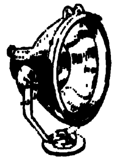
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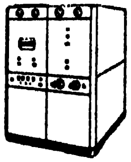
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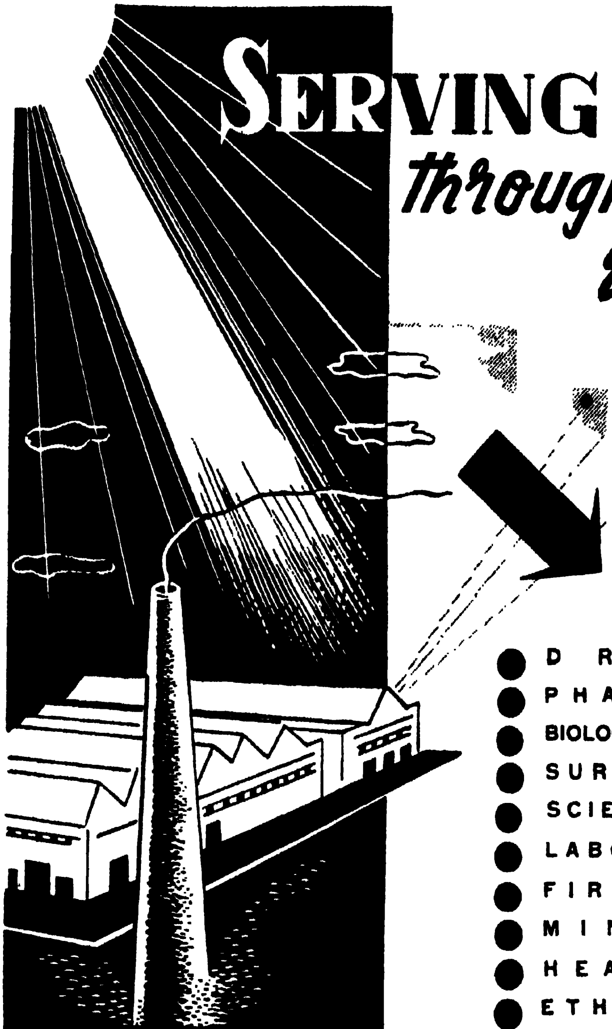

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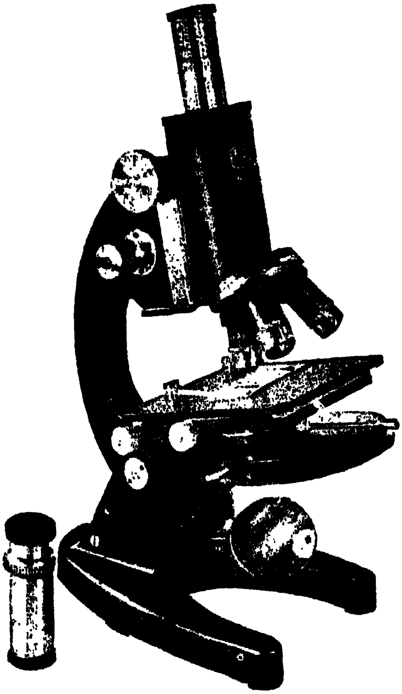

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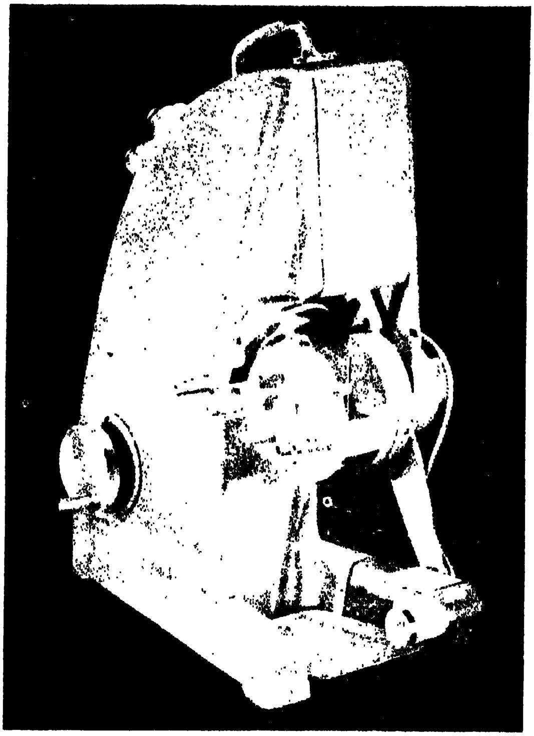

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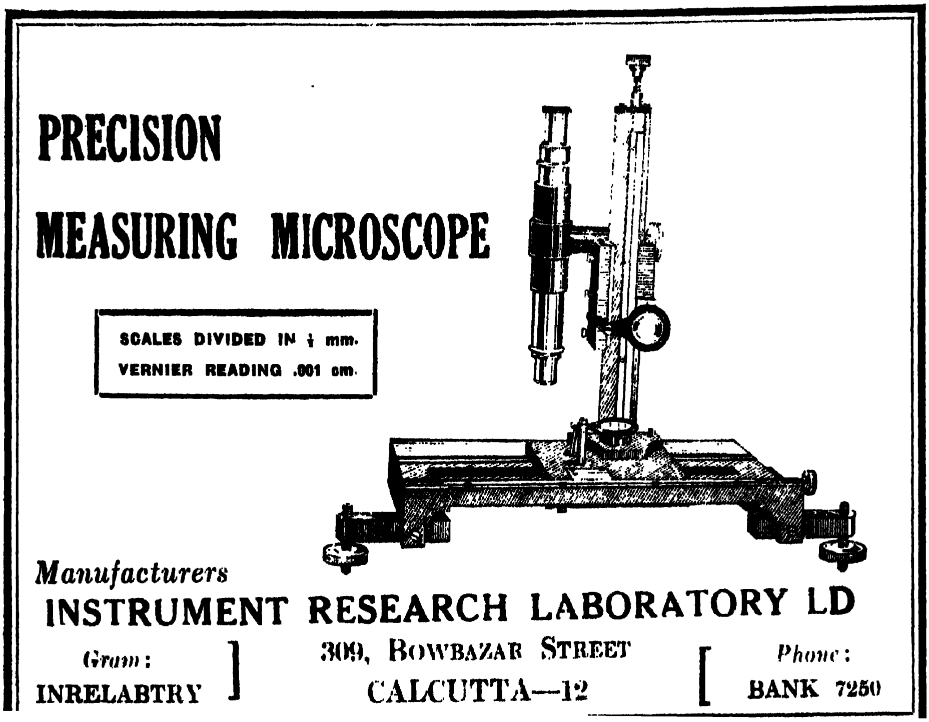

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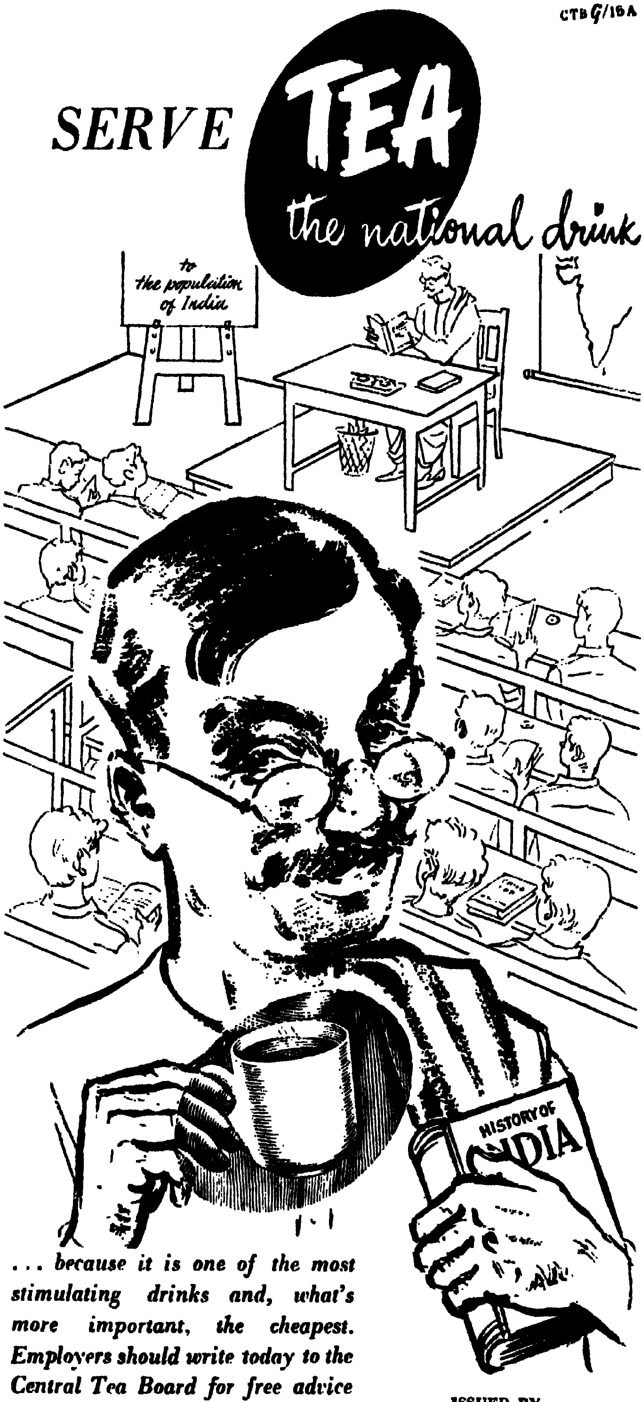
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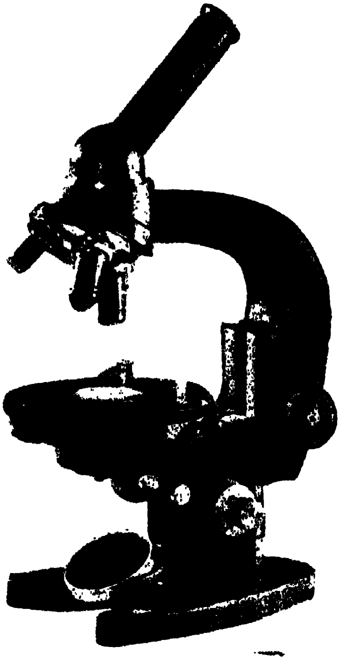

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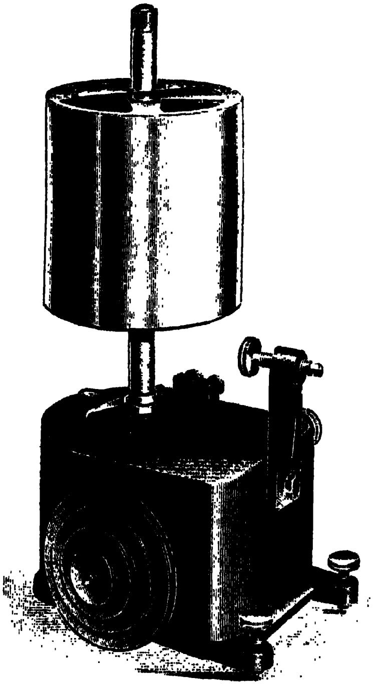

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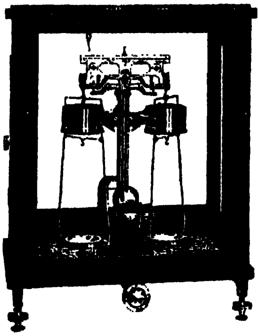

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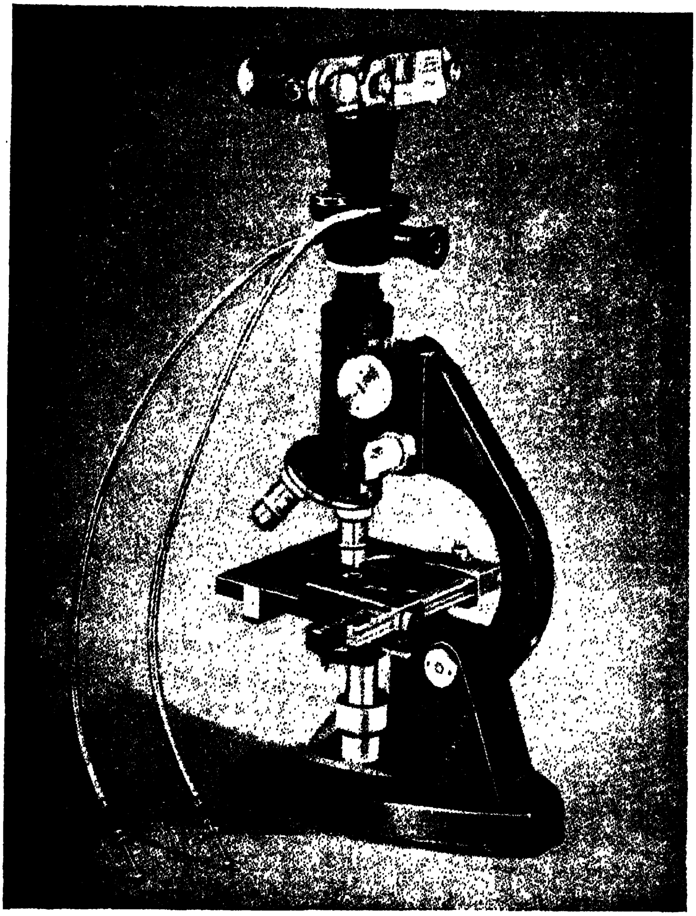

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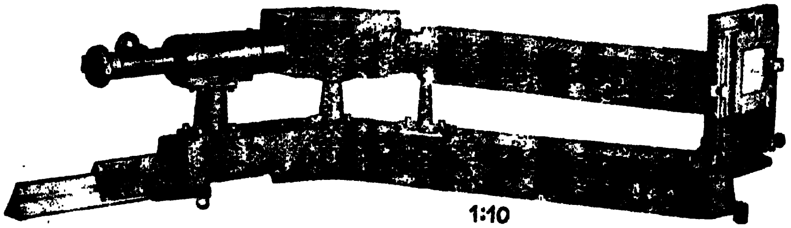

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SECTION I

GENERAL FEATURES

History of Calcutta

THE city of Calcutta, the first and foremost in the whole of India, appears to be of rather recent origin. In Bengali the place is known as *Kalikātā* and in mediaeval Bengali poems like the *Manasāmangala* of Vipradāsa (said to have been composed in 1495 A.D.) and the *Chaṇḍikāvya* of Kavikaṅkaṇa Mukundarāma Chakravartī (composed between 1577 and 1597 A.D.) Kalikātā is mentioned only as small hamlet, close to the sacred *tīrtha* of Kālikshetra or Kalighat. The *Ain-i-Akbari* of Abul Fazl (c. 1590 A.D.) also refers to Kalikātā as a *Mahal* within the *Sarkar* of Satgaon (Saptagrāma). Saptagrāma on the river Sarasvatī was a famous inland port in those days and an important centre of trade and commerce in Bengal. Its decay, however, began with the silting up of the river Sarasvatī and by the close of the 16th century A.D., Hooghly on the right bank of the main channel of the Ganges supplanted Saptagrāma as the foremost commercial centre in Bengal. The piratical and other incendiary actions of the Portuguese merchants settled there led to a punitive expedition by the Mughals in 1632 A.D. and the fall of Hooghly meant the decline of the Portuguese trade. This almost synchronized with the grant of a Charter to the English merchants by Prince Shuja for trading in Bengal on payment of Rs. 3,000 per year.

English at Calcutta and Job Charnock

Late in the 17th century the English in Bengal came into conflict with the Mughal power as a result of the vexatious interference with their trade by the local officers. Job Charnock, the Agent of the English Company, ransacked Hooghly in 1686. On the approach of the Nawab's army he was compelled to retire further down to Sutanuti, already a growing village on the left bank of the river Hooghly and contiguous to the village of Kalikāta. A reconciliation was soon effected and permission was accorded to the English Company to carry on their trade as before at Hooghly. But the village of Sutanuti, as being within reach of sea-going vessels, offered greater attraction as a commercial station and Charnock stopped at Sutanuti again in 1687 to "recruit provisions" and to "spin out the monsoon" and for the third time on August 24, 1680. Aware of the manifold advantages of the place, he deliberately rejected the Nawab's proposal of an establishment at Hooghly and decided to settle at Sutanuti in mud and thatched structures till ground for building a factory would be available.

Three villages, set amidst marsh and forest, occupied at that time the site on which the city of Calcutta was to grow. Sutanuti, where Charnock landed, stretched lengthwise along the river bank from Chitpur southwards. Situated by the deep waters it provided safe anchorage to trading vessels and was already a growing centre of trade in cotton goods. Calcutta (Kalikātā), occupying the high ground to the south of Sutanuti, lay somewhat back from the river and extended southwards up to a creek which coming from the marshy ground flowed to the river by a course that may roughly be said to be marked by the present-day Hastings Street. Lower down the river was Govindapur extending along the bank up to the Ādi Gaṅgā or Tolly's nullah. This area at that time was covered by a jungle of heavy undergrowth and intersected by numerous water courses. All the three villages were just collections of mud and thatched hovels in a marshy and swampy soil. It was amidst these adverse and unhealthy surroundings that foundations were laid of the premier city of modern India.

In an oft-quoted poem Rudyard Kipling has described Calcutta as "chance-directed" and "chance-erected". The selection of this site for an English settlement in Bengal cannot, however, be said to be due to mere chance. On the decline of the port of Saptagrām, four families of Basaks (Indian caste of weavers) and a family of Set (Indian banker) had moved down close to the deep waters and settled at Sutanuti. The fall of Hooghly in 1632 had diverted again a portion of the native merchants to this direction. Thus Sutanuti with its accessibility to sea-going vessels and the prosperous colony of Indian merchants offered certainly greater attractions to a trading company than did Hooghly which was already declining. Favourably situated at the gate of the principal waterways of Northern India, the site commanded practically all approaches to the rich Indo-Gangetic plains. Moreover, its position on the eastern bank of the river, isolated further the Chitpur creek on the north and the Salt lakes—more extensive than now—on the east, rendered it strategically more immune from outside attacks and depredations. The old pilgrim road from Chitpur to Kalighat, "forming a string to the bow of the river", provided as good a communication with the interior as was possible in those days. "There can be no greater mistake", says Wilson, "than to suppose that the English settlement at Calcutta was fortuitous and ill-considered."

In 1690, Charnock, who became the first Governor of the establishment, invited by a proclamation people of all nationalities to come and settle in the three villages, Sutanuti, Calcutta and Govindapur, and offered them special privileges and immunities. The Portuguese, the Armenians, the Hindus, the Muslims, induced by the assurance given, began to congregate and the place rapidly grew in importance. Unfortunately, however, the settlement did not fare well during Charnock's Governorship. Worn out by thirty-six years of hard work in an alien and exhausting climate he broke down under the distressing conditions in the new settlement and his declining years were spent in indolence and even in disorder. The affairs soon turned into a state of confusion. Though an imperial *firman* had been obtained in 1691 permitting the Company to "contentedly continue their trade" on payment of Rs. 3,000 a year by way of all dues, nothing was done to mark out a site for the factory, to clear jungles, to construct roads or to build houses. A general letter to the Court of Directors, dated May 25, 1691, graphically summarizes the life of the early traders in Calcutta: "They lived in a wild and unsettled condition at Chutanutee, neither fortified houses, nor godowns, only tents, huts and boats." Charnock died on January 10, 1692 and was buried in the burial ground of the settlement. Charles Eyre, his son-in-law, erected a mausoleum over his remains and this, believed to be the earliest piece of masonry raised up by the English, stands to this day in an excellent preservation in St. John's Churchyard.

Between 1692 to 1756

However critics may disagree, the founder of Calcutta now stands forth as a "block of rough-hewn British manhood", possessed of a "resolute courage which no danger could daunt nor any difficulties turn aside". In the State papers he has been described as "always a faithful man to the Company". Ellis, his second in command who succeeded him, was a man of little character or ability. Charnock's son-in-law, Charles Eyre, who became the next Agent, had a commanding personality and strong initiative and enterprise and it was under his administration that the affairs of the Company in Bengal were brought to order. As early as 1693, Sir John Goldsborough, the Commissary-General and Chief Governor of the Company's settlements in India, had selected a site for a factory, not at Sutanuti, but at 'Dhee Collecotta', and had enclosed it with a mud wall. The site marked was on the highest piece of ground to the west of what is now Dalhousie Square, by the bank of the river which then flowed much further east than now. Two fortunate circumstances which happened about this time materially helped to strengthen the position of the English in Bengal. The first was the rebellion of Shobha Singh in 1696, which secured for the English the long-delayed permission from the Nawab "to defend themselves". Immediately fortifications were commenced and by 1697 a walled enclosure with a bastion was completed on the site marked by Sir John Goldsborough and now occupied by the General Post Office, the Customs House and the East Indian Railway House. In 1700, the fort was named after William III, the then reigning British sovereign.

The appointment of Azim-us-Shan, a grandson of Aurangzeb, as Governor of Bengal represents another fortunate circumstance which materially assisted the English Company. The pleasure-loving young prince, on consideration of a gratification of Rs. 16,000 received from the Company, granted them, on August 1, 1698, the permission to purchase the three villages of Sutanuti, Calcutta and Govindapur. Accordingly, the three villages were purchased from their proprietors for Rs 1,300 by a deed dated November 10, 1698. This was a great advance for the English Company as it secured for them a legally assured status, though the Emperor's confirmation of the authority was still lacking. This they had a great difficulty in obtaining on account of oppositions from interested quarters, particularly from the local government in Bengal. In 1715, the Company sent an embassy to Delhi for this purpose. The embassy had to wait long, and another lucky incident, the cure of the Emperor Farrukhsiyar of a malady by Surgeon Hamilton of the English embassy, secured for the Company, in 1717, the desired *firman* which, along with a confirmation of the previous transaction, authorized the English to purchase 38 more villages on either bank of the river. With the imperial confirmation of their rights as legal owners of their settlement and the surrounding villages the English Company became firmly established in Bengal, and Calcutta "increased yearly in wealth, beauty and riches".

Until December, 1699 the Bengal establishment was subordinate to Fort St. George, Madras. In 1700, the Presidency of Bengal was created and Charles Eyre returned to Bengal as its first President. In 1702, construction of the President's House was started and completed four years later. It has been described by Hamilton as "the best and most regular piece of architecture in India". A single-storeyed house for the servants of the Company—the first Writers' Buildings—was erected in 1706 on the site of the old factory house that was pulled down. The death of Aurangzeb in 1707 brought in a state of general insecurity and the English found in it an opportunity of adding to the fortifications by hastily putting up two more bastions on the river side. On the eastern side of the Fort the merchants had begun to build, and the mud-walled and thatched structures of a quarter of a century before gave place to brick-built terraced houses with gardens. The tank in front, the present *Lal Dighi*, was re-excavated and deepened in 1709 for the supply of drinking water and the surrounding space was laid out as a park and planted with orange trees and ornamental shrubs. In the same year was built a church, the Church of St. Anne, which stood on the site now occupied by the western end of the present Secretariat Buildings and adjoined the main gate of the fort. Another church, the Church of St. Nazareth, was built by the Armenians in 1724 and is now the oldest church extant in Calcutta. The three villages had grown by this time into a thriving town with a population of some ten or twelve hundred Europeans and nearly a lakh of Indians. The gentlemen and ladies in Bengal, mostly wives and daughters of the senior merchants, "lived both splendidly and pleasantly", as Captain Hamilton records. The place, however, remained as unhealthy as before and mortality was high.

Thus did the city prosper along with the growth of the Company's trade, the shipping about the third decade of the 18th century amounting to ten thousand tons every year. The terrible storm and earthquake of 1737, accompanied by 15 inches of rainfall within five hours, devastated the country for sixty leagues up the Ganges and caused a good deal of damage to Calcutta. Many of the buildings were destroyed, including the Church of St. Anne, and an account of the harrowing details may be found in the *Gentleman's Magazine* for June, 1738. No sooner had Calcutta recovered from this calamity than a new menace appeared with the depredations of the Mahrattas which laid waste whole tracts of the country to the west of the river Hooghly. The inhabitants of Calcutta undertook to dig a wide ditch to extend like a semi-circle for seven miles round the three villages which formed the town. Work was begun in 1742 at the Chitpur end and in six months three miles, roughly following the line of the Circular Road southwards as far as Jaunbazar Street, was completed. Seven batteries were also placed in different parts of the town in apprehension of the danger. The work on the ditch was stopped on the Nawab of Bengal coming to terms with the Mahrattas. The unfinished Mahratta ditch which obtained the sobriquet of *'ditchers'* for generations of Calcutta citizens remained for nearly sixty years more or less as a pestilential drain and was filled up in 1799 when the Circular Road was made.

Sirajuddaulah and the English

Aliverdi Khan, the Nawab of Bengal, died in 1756 and was succeeded by his young grandson, Sirajuddaulah. The relations of the English merchants with the Nawabs of Bengal had never been cordial, as the latter could not possibly ignore the various unauthorized acts of the Company in those days of general lawlessness in strengthening and consolidating their position. The accession of the new Nawab brought the matters to a crisis which proved to be of far-reaching consequences not only to Calcutta or Bengal, but to the whole of India. It is said that the young Nawab looked upon the English as interlopers, perhaps not without reason so far as the authority of the State was concerned. As the head of the State he cannot but view with misgiving the extension of the fortifications at Calcutta. Moreover, the shelter given to the family of Raja Rajbullubh by the English at Calcutta and their refusal to deliver them to the Nawab's officers when called upon to do so represented acts of open defiance to the Nawab's authority. Hostilities broke out and the Nawab marched upon Calcutta with an army. The Nawab's army approached and surrounded the Fort on June 18, 1756, the small garrison was overpowered and the Nawab entered the Fort victorious on June 20, 1756. To commemorate his victory the Nawab changed the name of Calcutta to Alinagar and left for Murshidabad after appointing a Governor who had his seat at Alipur, about three miles south of the Fort.

The fall of Calcutta meant a great disaster to the English and an avenging army with troops and ships under Colonel Clive and Admiral Watson arrived from Madras late in December, 1756. On the approach of Clive and Watson, the Nawab temporarily withdrew his forces, but again advanced upon Calcutta. After a series of attacks and counter attacks, a treaty was concluded on February 9, 1757, by which the Nawab restored the trading privileges of the Company and offered to make restitution for damaged property.

About this time was set a sordid drama of treachery and intrigues against the Nawab and the English under Clive joined it whole-heartedly to turn the situation in their favour. The war between France and England in Europe also complicated matters in India. The strained relations between the English and the French in Bengal precipitated the hostilities between the Nawab and the English which ultimately led to the Battle of Plassey on June 23, 1757. The English under Clive won the battle without much fight and set up Mir Jafar, an uncle of Sirajuddaulah, who played an important rôle in the intrigues of Clive, as the new Nawab. Mir Jafar lost no time in expressing his gratefulness by making free gift of Calcutta and zemindary rights in the tract of land from the south of Calcutta up to Culpee to the English. Heavy compensation was paid to the Company and to the Company's officers and permission was granted for the establishment of a mint.

Calcutta after Plassey

The victory at Plassey established the English virtually as the supreme authority in Bengal and opened the way for further territorial and political aggressions. Their headquarters at Calcutta prospered and the city began to expand in area as well as in importance. With part of the compensation money received from the Nawab, the village of Govindapur was cleared and foundations were laid of the present Fort William in 1758. The Fort was completed in 1781 at a cost of two million sterling. The clearance of the jungle round the Fort led to creation of the ***maidan***, the broad expanse of which forms one of the chief attractions of Calcutta. A portion of the compensation money was also utilized in erecting a mint and other public buildings. The European quarter, once located between Bowbazar and Hastings Streets, began to spread southwards along the Chowringhee. The houses of important officers of the Company were stately buildings within the city, while palatial garden-houses sprang up in the suburbs, such as at Dum Dum, Alipur, Garden Reach, etc. But the city and its buildings grew up in a haphazard manner and as a contemporary writer records, the town was "a confusion of very superb and very shoddy houses, dead walls, straw huts, warehouses and I know what not".

With the grant of the Diwany of Bengal, Bihar and Orissa to the Company by the derelict Emperor Shah Alam II, the Nawab became a mere pensioner in the hands of the English who became virtually the rulers of this vast tract of territory. Calcutta gained further in prestige when in 1774 the Governor of Bengal became the Governor-General with authority over Bombay and Madras and Calcutta became the metropolis of the English government in India. A Supreme Court of Judicature was established at Calcutta, the Exchequer was trans-

VIEW OF CLIVE STREET (NOW NETAJI SUBHAS ROAD)

(From D'Oyly's *Views of Calcutta*, 1848)

CHURCH ENTRANCE TO THE DHURRUMTOLLAH

(From D'Oyly's *Views of Calcutta*, 1848)

LALL BAZAR

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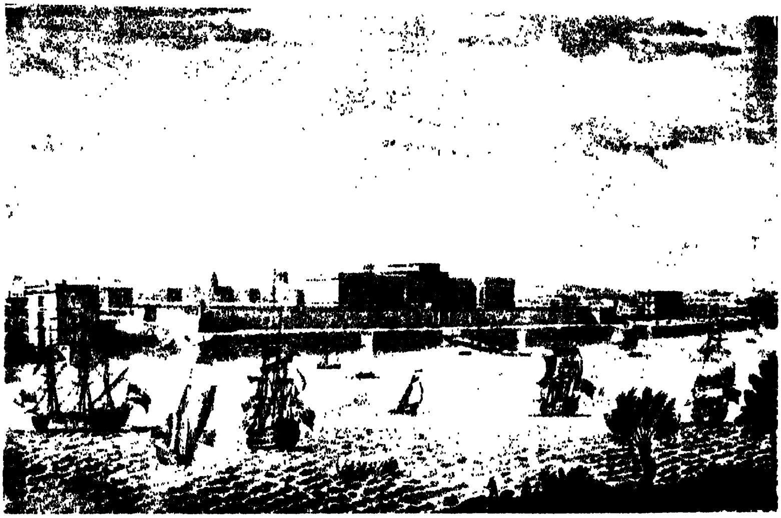


FORT WILLIAM IN BENGAL (1756)—Lambert Scott ferred from Murshidabad to Calcutta, and, on the abolition of the five Provincial Revenue Councils at Burdwan, Dacca, Dinajpur, Murshidabad and Patna, a Committe of Revenue was set up at Calcutta. Apart from increased importance and prestige in the political sphere, Calcutta took the lead in the intellectual sphere also with the establishment, in 1784, of the Asiatic Society which initiated studies in the humanities and the sciences on modern lines and has ever been at the root of all cultural and scientific activities in India. The scheme of building a Presidency Church took shape in December, 1783 when a Building Committee, with the Governor-General as the President, was appointed to receive subscriptions for this purpose. Money was also raised by lotteries and a liberal State aid and through certain unauthorized diversions of State money by Warren Hastings. With the money thus raised the old Cathedral of St. John was completed in 1787. The administration of Warren Hastings, although full of corruption and injustice, was at least responsible for raising Calcutta to a status of foremost pre-eminence among the other cities of India.

William Hodges, a noted English painter, travelled over different parts of India between the years 1780 and 1783 and left an excellent account of Calcutta which may be extracted to visualize the grand panorama of the city in those days. "As the ship approaches Calcutta the river narrows ; that which is called Garden Reach, presents a view of handsome buildings, on a flat surrounded by gardens: these are villas belonging to the opulent inhabitants of Calcutta. The vessel has no sooner gained one other reach of the river than the whole city of Calcutta bursts upon the eye. The capital of the British dominions in the East is marked by a considerable fortress, on the south side of the river, which is allowed to be, in strength and correctness of design, superior to any in India. On the foreground of the picture is the water-gate of the fort, which reflects great honour on the talents of the Engineer—the ingenius Colonel Polier. The glacis and esplanade are seen in perspective, bounded by a range of beautiful and regular buildings ; and a considerable reach of the river, with vessels of various classes and sizes, from the largest Indiamen to the smallest boat of the country, closes the scene". After landing he continues, this great city "extends from the western point of the Fort William, along the banks of the river, almost to the village of Cossipore: that is, about four and a half English miles. The breadth in many parts is inconsiderable. The streets are broad: the line of buildings surrounding the two sides of the esplanade of the fort is magnificent ; and it adds greatly to the superb appearance that the houses are detached from each other, and insulated in a great space. The buildings are all on a large scale . . . The general approach to the houses is by a flight of steps with great projecting porticoes, or surrounded by colonades or arcades, which give them the appearance of Grecian temples."

Under Lord Wellesley, whose sense of the value of pomp has earned for him the title of "Sultanized Englishman", the present Government House came into existence. Commenced in 1799, the "great apartments" of this magnificent house were opened for the first time on May 4, 1802. To Lord Wellesley again the city owes many civic reforms which led to improved sanitation and increased convenience and comfort of the inhabitants of the city.

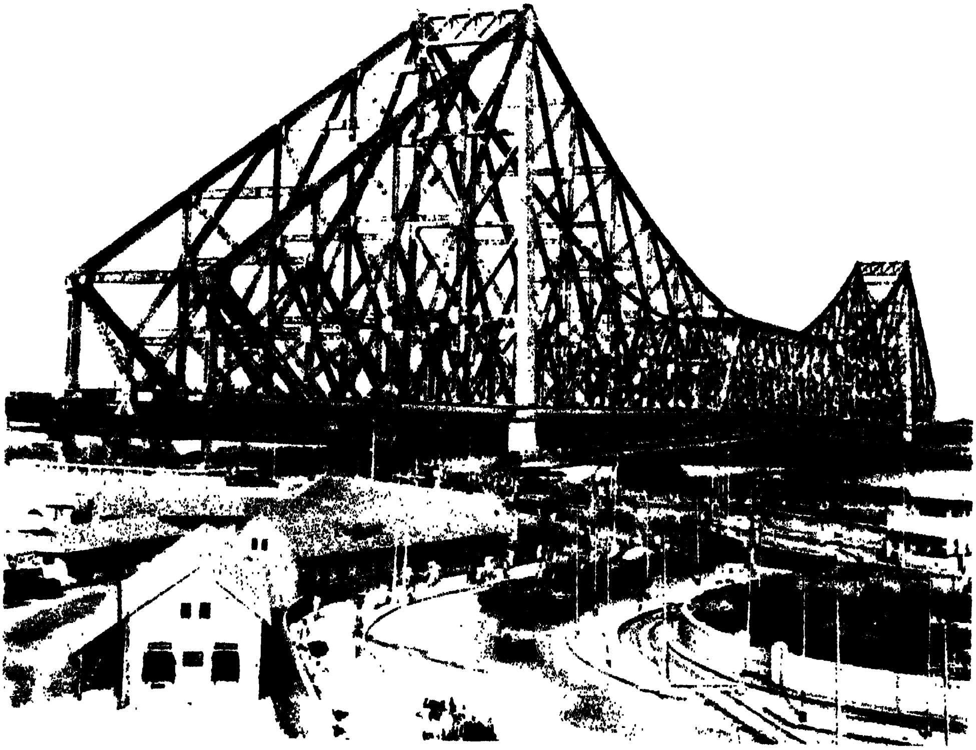
Since Wellesley's time Calcutta continued to prosper systematically with the expansion of the British dominions in India. The abolition of the Company's monopoly in trade by the Charter of 1813 encouraged private trading agencies and corporations and resulted in increased trade and prosperity to the city. The failure of five of the Agency Houses between 1830 and 1834 and of the Union Bank in 1847 brought in crisis in the commercial sphere ; but the crisis was only temporary and recovery was almost immediate. Perhaps, as a result of such circumstances, the Calcutta Chamber of Commerce, the forerunner of the Bengal Chamber of Commerce of the present day, was constituted in 1834. The Calcutta Trades Association came into existence slightly earlier.

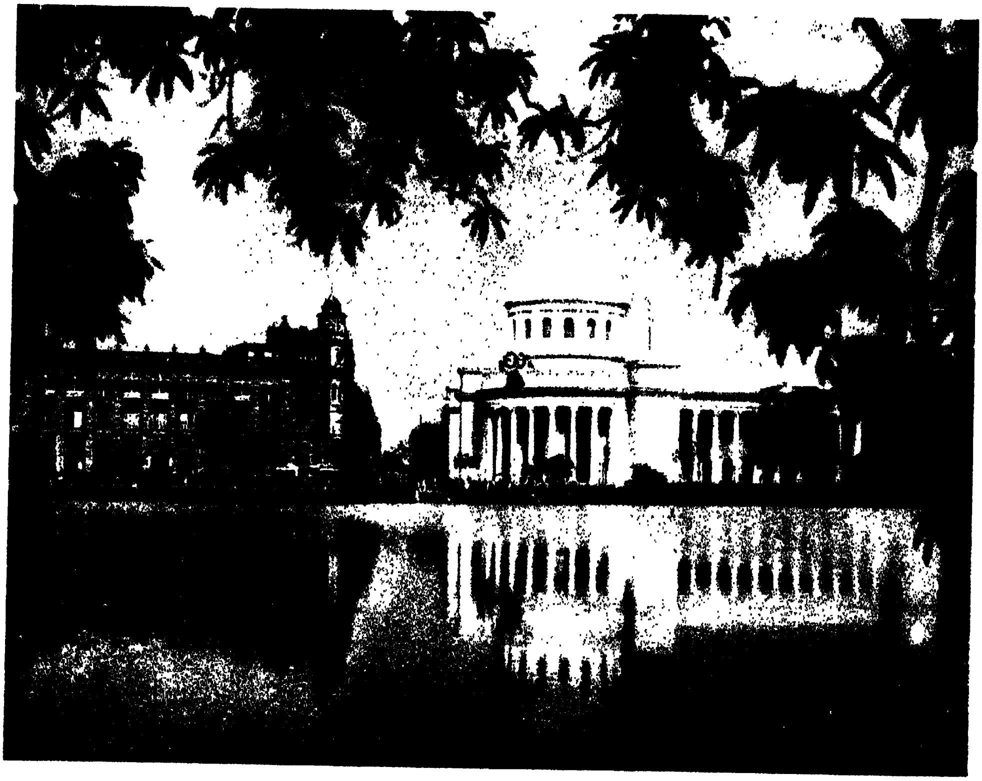
A desire for improvement of the city is also manifest among the public-spirited inhabitants. A century and a half ago a lottery was the most popular means of raising funds for any public purpose. St. John's Church, it has already been observed, was built with money obtained partly by lottery. In 1804, one such lottery was organized for the erection of the Town Hall and was repeated for several years. The Town Hall was commenced in 1805 and completed in 1813. So popular did the Town Hall Lottery become that later on it was merged into a larger scheme of lotteries, instituted by an order of the Governor-General in Council, the Lottery Fund being applied "to the expense of excavating new tanks and filling up of old ones, of opening new streets or roads, of constructing aqueducts, bridges, ghauts, and other similar works calculated to improve the health, convenience and comfort of the inhabitants of the city and the suburbs". Excellent work was carried out with the Lottery Fund, though it is difficult to ascertain the exact improvements executed by the Lottery Committee. From this period date some of the most important streets of the business quarter of the city. On the receding of the river further out the Strand with its busy wharves and warehouses was constructed. A fine avenue of trees was laid out along the river bank from the Chandpal Ghaut to the Fort, and was known as Respondentia Walk for the Calcutta Society to promenade in the cool evening. Much of this old walk has now been absorbed in the famous Eden Gardens, laid out under the direction of the talented Misses Edens, sisters of the Governor-General Lord Auckland

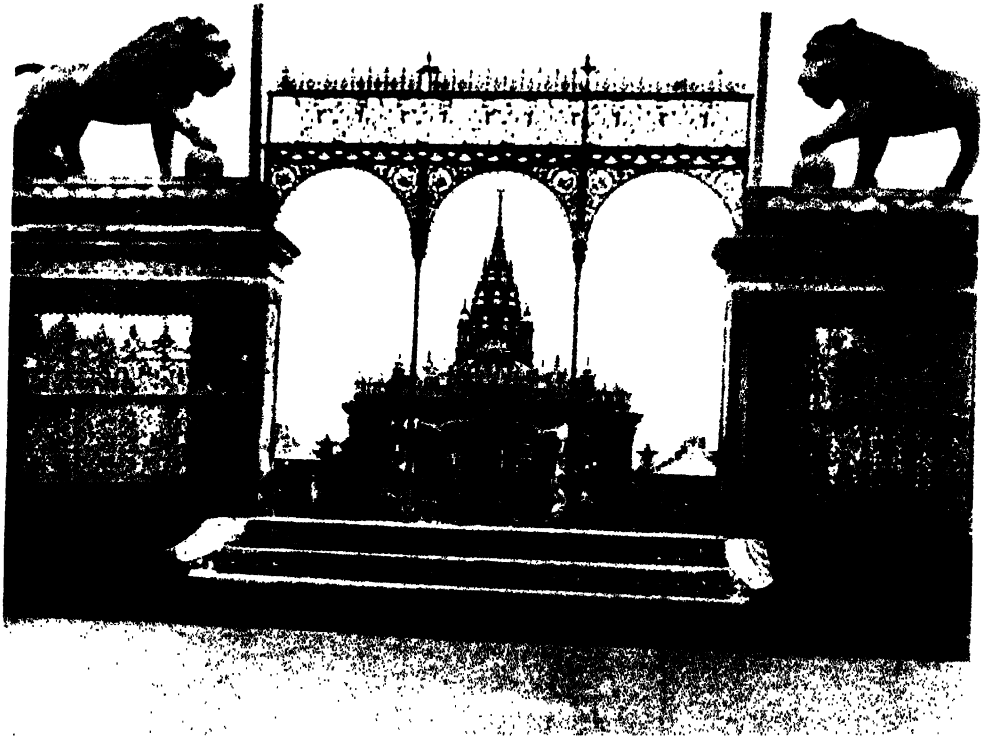
The port of Calcutta is one of the leading ports in the East. A large volume of trade is carried on through this port and because the navigation is difficult on account of shifting shoals and sandbanks the maintenance is naturally expensive and demands expert technical service. The Port Commissioners, instituted in 1870, administers the Calcutta port and to this body are due the modern scientific improvements of the port and its appurtenances.

Calcutta—Birthplace of Indian Nationhood

Calcutta with the rest of Bengal felt the first impact of Western ideas and culture and this impact manifested itself in various ways. In the first half of the 19th century, Raja Rammohan Roy started the Brahmo Samaj which meant an emancipation from the shackles of tradition and made the people receptive to new ideas and thoughts. This new religious system may also be said to have at the







root of several reformist movements, social, intellectual as well as political. Raja Rammohan was a champion of the move for the abolition of the *Suttee*. The movement for remarriage of widows was also started at Calcutta, and it was mainly through the initiative of Pundit Iswar Chandra Vidyasagar that the Widow-remarriage Act of 1856 was passed. Vidyasagar also started a campaign against the institution of polygamy and this movement has been able to change public opinion in such a way that polygamy is practically unheard of in Hindu society now-a-days. With Calcutta are also associated the hallowed names of Ramakrishna Paramahamsa and Swami Vivekananda, the latter inspiring a world-wide humanitarian organization, the Ramakrishna Mission. In the spread of Western education Calcutta took the lead and research institutions, scientific as well as cultural, came into being and made important contributions to the advancement of knowledge. It was in Calcutta again that the first awakenings of political consciousness were felt, and the British Indian Association (1851), the Indigo movement, the Indian Association (1876), etc. paved the way for the Congress organization which played so important a part in the country's liberation. "What Bengal thinks today India thinks tomorrow", said Gokhale. This eulogy is due to the fact that Calcutta has been the birthplace of all advanced ideas in this country.

Geology of West Bengal

THE State of West Bengal is mainly an alluvial plain with the Sikkim Himalaya to the north and the Peninsular block to the south-west. These geographical divisions were considered at one time to correspond to different facies of the stratigraphical succession, but there is hardly any doubt now that the Lesser Himalaya with its thick sequence of unfossiliferous sediments is made up largely of outer fringes of the Peninsula. The rocks of the south flank of the Himalayas near Darjeeling are thus a northerly extension of the pre-Cambrian and Gondwana formations caught in the great earth folds which produced the Himalayan mountain system. Accompanying this marginal buckling was a pronounced depression of another parallel belt of the Peninsular tract in between the two, and in this way was produced a deep trough which was rapidly filled up with Tertiary and recent river deposits, giving rise to a foothills belt and the present alluvial plain respectively. The depression perhaps began to form in Upper Eocene and attained its greatest development in Middle Miocene. The sea which separated the rising Himalaya from the Peninsula gradually gave place to a river (sometimes referred to as Indo-Braham) or rivers in late Tertiary period, which deposited the alluvium now comprising the foothills belt and the descendents of this Tertiary drainage, the Ganga and the Brahmaputra, have given rise to the alluvial plain of Bengal.

The Bay of Bengal began to have its present configuration from Upper Jurassic. It had a gulf extending into Assam and Burma which was subdivided into an Assam gulf and a Burma gulf in Upper Cretaceous or early Eocene by the formation of the Arakan mountains.

It is generally assumed, following the ideas of Eduard Suess, that the sediments of the Himalayan Geosyncline were lifted up by the pressure exerted against the Peninsula by the country to the north. To explain certain anomalies on a regional scale, an alternative suggestion has been put forward that the Pacific region and the Indian region have been underthrust towards Central Asia. Whatever the interpretations, the dynamical effect would appear to be the same. Geodetic surveys have shown that, roughly parallel to the front edge of the Peninsula, there are two belts of high and low density which are known as Burrard's 'Hidden Range' and 'Hidden Trough' respectively. In recent years a few other similar belts have been discovered and are described as upwarps and downwarps. One of these upwarps is along the Shillong plateau and the southern limit of the alluvium in Bihar, while a downwarp has been noticed along the Ganga Valley.

Midnapur and Bankura

The Archæan rocks are exposed to a limited extent in the south-western part of Bengal, in the Midnapur and Bankura districts. The Midnapur area is contiguous with Dalbhum of Bihar and contains a small strip of gneisses and schists similar to those found in the latter, while a small fringe of the Archæans runs along the north-western edge of Bankura. The rest of Midnapur and Bankura districts are covered with alluvium, ferruginous grit, laterite and lateritic gravel.

The Dharwars of this tract are represented by hornblende schists and sillimanite-bearing biotite and quartz schists and quartzites. These have been injected by granite with the formation of composite gneiss. The gneissic rocks in the area belong to the Bengal gneiss facies. In Bankura is exposed an interesting suite of rocks comprising anorthosites, labradorite-pyroxene rocks, anorthosite-gabbro, grano-diorite, granite and pegmatite, which is intrusive into the Dharwars.

Raniganj Coalfield

The major portion of the Raniganj coalfield is included in the province of West Bengal. The Lower Gondwanas which comprise this coalfield are preserved within a faulted trough of the Archæans, the main boundary fault on the south having a throw amounting to at least 9,000 feet. The lowest member of the Gondwanas in the area is a glacial boulder-bed which is succeeded by shales and sandstones of the Talchir series. This is followed by massive felspathic sandstones, grits and conglomerates of the Barakar stage containing extensive coal seams and refractory clay bands. The Ironstone Shales come next and are overlain by the Raniganj stage consisting of fine sandstones and shales with important seams of coal. The topmost Gondwana horizon is the Panchet series overlain by the Durgapur beds. The latter consists of coarse sandstones and mottled clays resembling the Cuddalore sandstone (Miocene) of the East Coast, but may also be regarded as Supra-Panchets. These are of some interest in connection with the late geological history of the area near Calcutta as these and the capping of lateritic gravel of late Tertiary age pass under the Gangetic alluvium. About 30 per cent of the total annual production of coal in India comes from the Raniganj coalfield.

Darjeeling

Mounting from the 'tarai' plain towards the Himalaya in the Darjeeling district, there is first of all a fringe of Tertiary beds, followed by a narrow belt of the Damudas (Gondwanas), which in turn is overlain by the Daling series. Further up the hills, the slates of the Dalings pass more or less gradually into mica-schist and then into the Darjeeling gneiss. This succession belongs to an enormous recumbent southwardly-thrust anticline, only the inverted lower limb of which is now preserved. Copper pyrites, occasionally associated with other sulphide minerals, is found at several places disseminated among the slates and hornblende schists and has in some cases been worked.

A series of outcrops of coal-bearing Damuda strata have been traced along the southern margin of hills from Assam to Nepal. South of the Darjeeling synclinal these constitute a narrow band between the Dalings and the Tertiaries from Pankabari to near Dalingkot. However, as the seams are found severely crushed, overfolded and dipping at steep angles northwards into the hills, their exploitation is expensive and difficult.

Gangetic Plain

As mentioned earlier, the greater parts of West Bengal consists of Gangetic alluvium. The basement of this alluvium must be formed of the Peninsular rocks, but for a few miles along the northern border it is apparently underlain by a good thickness of the Tertiaries. We are still uncertain about the basement rocks which will be met under Calcutta, but the possibilities are restricted to laterite beds passing down into the Durgapur beds or the Tertiary strata corresponding to those noticed in Assam, Mayurbhanj and Orissa.

Despite the surface continuity of this alluvial plain, geodetic anomalies show that it is, in fact, sub-divided into several downwarps isolated by concealed but elevated extensions of the Peninsular formations. The north-east edge of the Peninsula by the Rajmahal hills almost certainly continues as a submerged elevation below the alluvium, joining up with the Garo hills of the Shillong plateau.

The sediments are sands and clays with occasional gravel beds and lenses of organic matter. The 'Older Alluvium' is rather dark coloured and generally rich in concretions of impure calcium carbonate. It forms slightly elevated terraces, the river having cut it to a lower level. The 'Newer Alluvium' is light coloured and poor in calcareous matter. It contains beds of sand or gravel and peat and merges gradually into the recent alluvium. Where the Ganga and the Brahmaputra meet to flow into the Bay of Bengal, they have built up a large delta. The

'Older Alluvium' of Bengal is at least younger than the Lowest Miocene as it apparently overlies the marine horizon of Baripada in Mayurbhanj and ends with laterite of pre-glacial origin. The 'Newer Alluvium' may be assigned Upper Pleistocene age. The apparent uplift of the region, when the rivers cut down at least 300 feet below their present levels before deposition of the 'Newer Alluvium', may in reality be the widespread fall of the sea level which accompanied the Pleistocene glaciation.

The mineral assemblage of the silt from Calcutta shows ilmenite, hornblende, garnet, epidote, kyanite, tourmaline, staurolite and sillimanite. It differs from that of the Assam alluvium in having sillimanite in quantity throughout. Material resembling peat occurs at a depth of 18 to 35 feet on both sides of the river Hooghly in and around Calcutta. It appears to have been deposited in an extensive marsh which has since been silted up.

The Ganga appears to have shifted eastwards and the Brahmaputra certainly moved westwards in recent times, towards the axis of a depression which connects the foredeep off the Arakan coast with the Bengal Gap.

Climate of West Bengal

WEST Bengal is a part of the great low land plain of north-east India with the eastern Himalayan range in the north, Bay of Bengal to the south and the eastern border of Chotanagpur plateau to the west. The northern part of this State comprises partly of the Darjeeling hills and partly of the sub-mountain tracts of lands, while the central and the southern parts are portions of the Gangetic delta. The climate of West Bengal is largely influenced by its relative position with reference to the eastern Himalayas and the Bay of Bengal.

Seasons

The year may be divided into three principal seasons: the cold season from November to February, the hot season from March to May and the wet season from June to October. The most important climatic feature is the alteration of the seasonal winds known as monsoons. In the cold season the general flow of the surface wind is from north-east, and the air prevailing over West Bengal during this season being of land origin contains very little moisture. So clear skies and fine weather are the usual features of this season, broken only at intervals due to the eastward passage of weather disturbances from the west. The hot season of March to May is a period of continuous increase of temperature and April and May record the highest temperature of the year at almost all places of the plains of West Bengal. During this season the land and sea winds give rise to large contrasts of temperature and humidity and consequently to violent local storms, especially in the southern districts. These local storms are often of tornadic intensity and are usually called Nor'westers or *Kalbaisakhi.* The south-west monsoon sets in over Bengal towards the beginning of June, prevails over the State till September and begins to withdraw early in October. The prevalence of south-west monsoon during the months of June to October causes an influx of abundant moisture over West Bengal and is thus responsible for wet and cloudy weather during this season. The activity of the monsoon during this period is, however, largely influenced by the westward passage of storms and depressions originating from the bay. Exceptionally heavy rain often occurs along and near the tracts of these storms and depressions.

In order to bring out the essential features of the climate of West Bengal, the climatological data of Calcutta (Lat. 22°32'N Long. 88°20'E Alt. 21 ft.), Malda (Lat. 25°02'N Long. 88°08'E Alt. 103 ft.) and Darjeeling (Lat. 27°03'N Long. 88°16'E Alt. 7,432 ft.) are given in the Tables that follow.

Rainfall

The normal monthly and annual total rainfall and the number of rainy days for Calcutta, Malda and Darjeeling are given in Table I. Figures of heaviest rainfall recorded in 24 hours have also been included in the Table. It will be seen that about 80 to 85 per cent of the annual rainfall and rainy days occur during the south-west monsoon season of June to October and 10 to 15 per cent of the annual rainfall and rainy days occur due to thunderstorms in the hot months of March to May. The very scanty falls during the winter months are generally in association with the passage of western disturbances. It may be observed that the rainfall in the hills and sub-mountain districts of West Bengal is much larger than that in other parts of the State. This is due to the peculiar orography and topography of that part of the State. It may be mentioned that in regard to the total annual rainfall, West Bengal holds an intermediate position between the areas to its east and west, rainfall being more to the east and less to the west.

Temperature

Table II gives normals of temperature during the different months and the year as a whole at the three stations. It may be observed that over the plains, the average maximum temperature is attained in April and the highest maximum in May. But over the Darjeeling hills the maximum temperature is attained in the months of June. The lowest temperature is attained all over West Bengal during the month of January. Due to its vicinity to the sea area, the diurnal variation of temperature in Bengal is not very large and as such this State, particularly its coastal area including Calcutta, enjoys more or less a maritime climate in contrast to the continental climate prevailing over north-west India which is characterized by large diurnal ranges of temperature.

TABLE—I

MONTHLY AND ANNUAL RAINFALL AND NUMBER OF RAINY DAYS AND HEAVIEST RAINFALL IN 24 HOURS

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Monthly Rainfall in inches	Calcutta	0.37	1.17	1.36	1.75	5.49	11.69	12.81	12.92	9.95	4.48	0.81	0.18	62.98
	Malda	0.54	0.83	0.77	1.18	4.60	9.82	11.48	11.02	11.52	4.35	0.45	0.07	56.63
	Darjeeling	0.53	1.19	1.88	4.14	9.63	24.18	32.92	26.56	18.90	5.41	0.81	0.27	126.42
Number of Rainy Days	Calcutta	0.8	1.8	2.3	3.0	6.9	13.2	17.5	18.0	13.2	6.2	1.1	0.3	84.3
	Malda	0.9	1.7	1.3	2.0	5.6	11.5	14.8	14.6	11.6	4.3	0.7	0.2	69.2
	Darjeeling	1.2	2.6	3.6	7.5	14.4	21.0	25.6	23.7	17.0	4.8	1.2	0.7	123.3
Heaviest Rain in 24 hours in inches	Calcutta	1.67	3.18	2.75	4.23	6.15	11.95	7.23	9.96	14.53	6.78	3.17	2.09	14.53
	Malda	1.34	1.57	1.49	2.15	5.40	4.67	6.38	7.40	8.00	6.84	1.00	1.29	8.00
	Darjeeling	1.50	1.67	1.62	5.32	9.17	9.65	7.62	9.35	19.40	8.85	8.65	1.23	19.40

TABLE—II

MONTHLY TEMPERATURE VARIATIONS

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Mean Temperature of	Calcutta	67.1	71.5	80.7	86.1	86.5	85.5	84.1	83.7	83.9	81.5	73.9	67.2	79.3
	Malda	62.3	66.7	75.9	84.4	85.3	84.9	84.3	84.1	83.7	80.2	71.7	64.1	77.3
	Darjeeling	41.2	42.2	49.2	55.0	57.7	60.7	61.9	61.7	60.3	55.9	49.3	43.5	53.3
Mean Maximum Temperature of	Calcutta	79.6	83.7	92.5	96.8	95.6	92.4	89.5	89.0	89.9	89.2	84.2	79.4	88.5
	Malda	74.5	79.3	90.1	97.5	95.4	91.5	89.7	89.1	89.0	88.1	82.3	75.8	86.9
	Darjeeling	47.0	47.8	55.4	61.2	62.9	64.9	65.7	65.6	64.6	61.7	55.6	50.5	58.6
Mean Minimum Temperature of	Calcutta	54.6	59.4	68.8	75.5	77.5	78.6	78.6	78.3	78.0	73.8	63.7	55.0	70.2
	Malda	50.0	54.1	61.6	71.3	75.3	78.2	79.0	79.1	78.3	72.3	61.1	52.5	67.7
	Darjeeling	35.4	36.6	43.0	48.8	52.4	56.5	58.0	57.7	56.0	50.2	43.1	36.6	47.9
Highest Maximum of	Calcutta	87.9	98.4	103.4	107.4	111.3	109.0	98.2	94.4	94.5	93.9	90.6	85.4	111.3
	Malda	84.1	92.9	105.8	109.2	112.5	104.1	100.1	97.6	96.6	94.1	92.1	82.8	112.5
	Darjeeling	61.1	62.4	72.2	79.8	76.7	80.1	77.3	76.6	79.7	72.2	67.8	62.7	80.1
Lowest Minimum of	Calcutta	44.2	45.9	50.2	60.9	65.0	70.2	67.7	73.6	71.8	62.9	51.1	45.0	44.2
	Malda	39.9	39.0	45.2	55.6	64.5	67.8	69.6	73.5	70.5	58.1	49.5	40.6	39.0
	Darjeeling	21.9	19.9	30.7	34.0	38.8	46.2	54.1	52.2	46.2	40.2	30.8	26.7	19.9

Relative Humidity

Table III gives the monthly and annual means of 8-30 and 1730 hrs. relative humidity at Calcutta, Malda and Darjeeling. The relative humidity is 75 per cent or more in the morning as well as in the afternoon during the monsoon months all over the State. In the rest of the year the relative humidity is also quite large, except over the central parts of the State. In regard to dampness of air, West Bengal, particularly a station like Calcutta, bears a strong contrast to a station in north-west India where humidity is generally low in the morning as well as in the evening, except during rainy weather. This is why one feels so sultry and uncomfortable at Calcutta during the non-winter months although the maximum temperature of Calcutta is much lower than that of a station like Delhi or Lucknow.

Cloudiness

The mean cloudiness estimated in tenths of sky covered for the 3 stations is given in Table IV. It may be observed that the sky is generally heavily clouded during the monsoon months and moderately clouded during the pre-monsoon months of April and May and clear or lightly clouded in winter. During the rainy season the cloud base lowers down even below 1,000 ft. on a number of occasions and covers the hill tops.

Surface Winds

Table V gives the mean wind speed in miles per hour and the prevailing direction of wind at Calcutta and Darjeeling and the mean wind speed in miles per hour at Malda. At Calcutta the wind is general from a southern direction (south-east and south-west) from March to September and westerly or north-westerly during the rest of the year. The wind speed is generally light but becomes occasionally gusty during the months March to June when squalls with maximum gust of 40 miles per hour or more are also experienced from time to time in the afternoon. It may be mentioned that the coastal districts of West Bengal including Calcutta get the evening sea breeze on most of the days during the months February to May characterized by its greater gustiness, humidity and lower temperature.

Cyclonic Storms

Table VI gives the total number of cyclonic storms and depressions of Bay origin which passed inland across West Bengal coast in different months during 20 years ending in 1950 and thus affected the weather of West Bengal, particularly its coastal districts.

Weather Phenomena

Table VII gives the frequency of thunder, hail, dust-storms, squalls and fog at Calcutta. Thunderstorms occur generally during the hot months of April and May and the monsoon months of June to October. Some of the thunderstorms

TABLE—III

RELATIVE HUMIDITY NORMALS (IN PERCENTAGE) AT 0830 AND 1730 HOURS I.S.T.

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1. Calcutta	0830	82	79	76	73	74	79	83	85	83	82	76	77	79
	1730	53	50	47	50	70	80	84	83	82	77	65	61	67
2. Malda	0830	72	71	49	50	71	81	82	83	81	75	72	73	72
	1730	55	52	35	28	60	76	80	82	81	73	69	67	63
3. Darjeeling	0830	75	76	69	72	86	93	93	92	90	81	69	66	80

TABLE—IV

AVERAGE CLOUD AMOUNT (ALL CLOUDS) (EIGHTHS OF SKY) AT 0830 HOURS I.S.T.

1. Calcutta ...	1.8	2.5	2.2	3.0	4.2	6.1	7.0	6.7	5.7	3.0	1.8	1.4	3.8
2. Malda	1.0	1.4	1.1	1.9	3.4	5.0	5.8	5.6	4.2	1.8	0.8	0.6	2.7
3. Darjeeling ...	3.4	3.8	3.0	3.9	5.6	6.9	7.1	7.0	6.4	4.3	2.9	2.6	4.7

TABLE—V

MEAN DIRECTION AT 0830 HRS./MEAN WIND SPEED IN MILES PER HOUR

	NW	NW	SW	SW	S	SE	SE	SE	SE	NW	NW	NW	SW
1. Calcutta ...	2.0	2.6	3.5	4.9	5.0	4.3	3.7	3.4	2.8	2.1	1.9	1.9	3.2
2. Malda	2.7	2.9	3.7	5.0	5.6	5.4	5.3	4.7	3.9	2.8	2.4	2.8	3.9
	SE	SE	SW	SE	NE	SE	NE	NE	NE	NE	NE	E	E
3. Darjeeling ...	2.6	4.1	5.0	5.7	4.8	3.9	3.5	3.4	3.2	2.6	2.0	1.9	3.6

TABLE—VI

TOTAL NUMBER OF CYCLONIC STORMS DURING 20 YEARS ENDING IN 1950

Jan.	Feb.	Mar.	Apr.	May.	June.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Total
0	0	0	0	3	7	21	23	12	13	2	0	81

TABLE—VII

* FREQUENCY OF WEATHER PHENOMENA (NUMBER OF DAYS) AT CALCUTTA

1. Thunder ...	1.0	3	5	6	13	16	13	12	18	7	0.5	0.1	94.6
2. Hail ...	0	0	0.1	0	0.1	0	0	0	0	0	0	0	0.2
3. Dust Storms ...	0	0	0.3	0.1	0	0	0	0	0	0	0	0	0.4
4. Squalls ...	1.0	1.6	2.5	2.4	7.5	7.3	3.7	3.6	3.5	1.5	0.1	0.1	34.8
5. Fog ...	9	8	3	0.1	0	0	0	0	0.1	0.4	2	5	27.6

* Thunder and fog frequencies above 2.0 are given only in whole numbers.

in April and May are known as Nor'westers (*Kalbaisakhi*) as they approach a station from the north-west and burst suddenly with great fury. Frequent thunder and lightning followed by heavy showers often with hail are experienced during these storms. During some of the storms the wind blows with almost

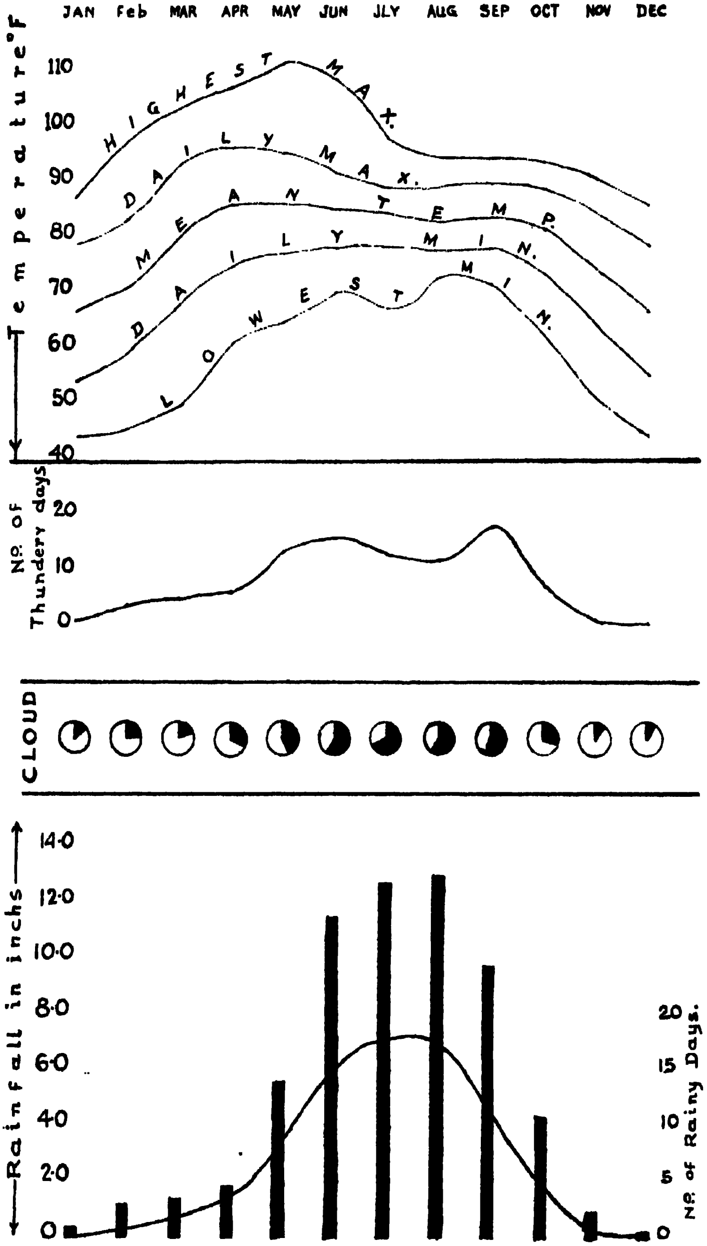


Chart showing climate conditions at Calcutta (Alipore) hurricane force. The highest wind speed recorded during one of the Nor'westers at Calcutta was 80 miles per hour on May 1, 1946. Morning fog and evening mist are quite frequent during winter, particularly in the coastal districts. In the industrial areas surrounding the city of Calcutta, smoke from the chimneys and households helps condensation of moisture of air during winter mornings and evenings and gives rise to a veil of mist or fog which remains suspended in the atmosphere for a considerable length of time.

The accompanying chart gives a picture of the average climatic conditions at Calcutta during the various months of the year.

Population of Calcutta

CALCUTTA now belongs as much to West Bengal as to India and the world. Her features, intensely local and individual, have acquired universality. Originating as a small town she is now bursting at the seams with overgrowth. She holds the record for density. Her population is steadily, steeply on the increase, due, as a deputy chairman of the city's Corporation fifty years ago claimed, to 'the benefits conferred by the much abused Calcutta Corporation', as much as to the fact that the city is as acceptable to the man in search of a situation in her vast folds as to the much travelled and educated mind.

Growth of Population

The increase in population within the last twenty years has been as remarkable as her growth during the past two centuries. The present area of Calcutta is 35.26 square miles (28.34 within municipal limits) and the population on March 1 last 2,548,677 ; in 1931, with almost the same area, her population was 1,163,771. In twenty years the population has thus more than doubled. In 1801, the area of the town was only 4,997 acres and its population under 140,000. In 1701, the area was only 1,682 acres with a population of 10,000. The regular decennial censuses began in 1881 with a total population that year of 433,219. In 1901, the population was 949,144 or just over thirty-six per cent of her present population. The rate of increase of the population of the metropolis of India has been greater than most cities of comparable size.

The average density is 88,953 persons per square mile or 138 persons per acre. The places of greatest density are Jorabagan (491 per acre), Jorasanko (450) and Coloothala (399); they have been the heart of the city since the seventeenth century. There are, however, wards like Watganj and Hastings with a density as low as 31, while wards 17 to 32 are generally on the low side. The Calcutta Improvement Trust are developing areas on the fringe of the city—tanks and paddy fields are being gradually covered with bricks and mortar and rural lanes and muddy paths transformed into macadamized roads, with kerb and channel stones—and offer them for sale, which serve to attract hungry settlers away from the congested areas of the city and distribute the density. The State Transport Department and the Calcutta Electric Supply Corporation are laying on public services and electricity with commendable speed, helping people to settle over a larger area, while several schemes are under the active consideration of the government to improve suburban rail and road services; and the city's police have quietly and steadily done a great deal to keep the road traffic reasonably fast, and bring the far flung suburbs within less than an hour's bus ride to the heart of the city.

The population in the immediate surroundings of the city, that is, in areas which are within half an hour's bus ride to a city terminus, has remarkably increased in the course of the last ten years, and is now 1,098,436. They are the spill areas of Calcutta, served by municipalities, and include Garden Reach (129,031), South Suburbs (Behala: 113,379) and Tollyganj (194,583) in the south; the Dum Dum group (Dum Dum, South Dum Dum and North Dum Dum: 87,549) in the north-east ; Baranagar (77,126) in the north; and Howrah (433,630) and Bally (63,138) in the west. This may be called the well-knit Calcutta area, the population of which, including Calcutta's, comes to 3,646,113. The corresponding population in 1941 was 2,839,726, and in 1931, 1,581,335. In twenty years the population of this area has increased 2.3 times.

The 'displaced' or refugee population returned from this area is 650,000 in round figures (Calcutta municipal area 433,228) which is roughly a third of the entire displaced population in West Bengal. An official survey reveals that about one hundred and ten colonies of all sizes of displaced persons have sprung into existence within this area east of the Hooghly river.

But this account of averages or even what is said below can at best give only an approximate idea of the real condition of the people. An area covered by buildings of 'the character of Queen Anne's mansions in London', or nearer home, in the Camac Street area, and having the same density per acre as an area covered by the class of structures found in a Calcutta *bustee*, would obviously be inhabited by a population which lived in conditions essentially different from those prevailing in the latter area. We can, therefore, arrive at a much more correct idea of the actual condition of the people by considering the question of house accommodation. The city's housing and other amenities, meagre and unsatisfactory since her origin, have been put to a sudden and severe strain since 1947. On March 1 there were 606,026 census units consisting of one room or more each and 710,579 living rooms; the average number of living rooms per census unit came to 1.17. They accommodated 25,48,677 persons or 4.2 persons per census unit. Of these, 685,146 persons did not lead family lives and 1,863,532 lived on a normal family pattern in 350,916 families. The average works out at 3.5 persons per living room (an average which masks acute cases of congestion where more than two families of different castes were frequently found to occupy the same room), and 5.3 persons per family, also a high figure which indicates that most families are now obliged to 'keep' distant relations or unrelated persons. The full impact of the sudden influx of a large displaced population (433,228) cannot be analyzed in this short space, but it will be sufficient to reflect that in the 3,615 *bustees* of Calcutta, having 21,556 huts and 155,624 living rooms, containing 617,374 souls (almost a quarter of Calcutta's population) no less than 112,515 are displaced refugees (18.2 per cent of the bustee population).

Predominance of Males over Females

When the results of the 1901 census were submitted the Lieutenant-Governor of Bengal observed that, next to the general expansion of the population of the town which proceeded during the nineteenth century, 'at a more rapid rate even than that of London', the most prominent features of the population were 'the predominance of males over females', and the 'increasing immigration of up-country men'. It is significant that these two features still continue to be pre-eminent.

The excessive predominance of the male element has been an abiding feature of Calcutta. In 1901, there were almost twenty males to every ten females. In 1951, in spite of the immigration of a large number of 'displaced' *families*, the unbalance is almost just as great: 503 females to 1000 males in 1901, 523 females to 1,000 males in 1951; in 1931, it was as bad as 468 females to 1,000 males. As in 1901, this is largely due to the large number of immigrants who have come to the city for work, having left their women behind at home, and proves that business, work, and livelihood are still the city's predominating characteristic. It is evident that in Calcutta there has never been much of family life and associated conditions; this is reflected not a little in her configuration. Until the Improvement Trust was constituted there were very few exclusively residential areas; business and factory areas made large inroads into them, and *bustees*—hives of artisans and labourers designed for single lives—were overrun by countless families. A great deal of disorder and untidiness persists with which the Improvement Trust, the transport network, and the police wage daily battle. It is by no means stretching a point too far to argue that the notorious instability of the city's civic peace is attributable to a certain measure to this disparity between males and females, the absence, encouraging recklessness, of family life which restrains moods of violence, the proximity of residence to place of work.

A cursory examination of Calcutta's civil condition will further illustrate this point. For lack of space figures of 1901 and 1951 only are quoted but an analysis of the figures of intermediate censuses will broadly confirm the conclusions of this paragraph. In 1901 there were 282,151 unmarried, 548,035 married and 118,958 widowed persons of both sexes: a total of 949,144. Their proportion to the total population were therefore 29.8, 57.7 and 12.5 per cent respectively. The ratio of unmarried males to unmarried females was a little less than 5.2, that of married males to married females 2.6:1, indicating that a large number of married men left their wives behind at home. On the other hand, there were considerably more than three times as many widowed females as widowed males. In 1951, in a systematic sample of 211,102 persons from a population of 2,115,449 (exclusive of the displaced population of 433,228 which will be discussed separately), there were 89,597 unmarried, 104,766 married and 16,739 widowed or divorced persons of both sexes. Their proportion to the sample population (the same proportion may be taken to apply to the whole population) was 42.5, 49.6 and 7.9 per cent respectively. The ratio of unmarried males to unmarried females was 1.8:1, and that of married males to unmarried females 2.3:1. Widowed or divorced females are about twice as numerous as widowed or divorced males. An important point to remember in this connection is that there is always a considerable prostitute population in Calcutta. In 1901, the majority of them returned themselves as widows, whereas, in 1951, as a result of a recent Act seeking to suppress immoral traffic, most of them, except those who are matronly, have returned themselves as married. This point duly considered, it will appear that Calcutta has made little progress towards normal home life. A total of 433,228 displaced population shows 234,242 males and 198,986 females. The proportion of unmarried, married, and widowed among them to their total population is 55.4, 36.2, and 8.4 per cent respectively. The ratio of the males to their females is very nearly 1.2:1 (1000:849), that of unmarried males to unmarried females 1.6:1, and that of married males to married females 1.04:1. Although among them widowed females are more than six times as numerous as widowed males, yet, considering the more even ratio of males to their females and the parity between their married males to married females, it may be concluded that the displaced population has introduced an element of social health in the life of the city. A point although trite is worthy of note in this connection. The bulk of refugee demonstrations that have protested on the streets of Calcutta in recent years were composed of persons imported from outside the city. Normal family life is a big stake to be risked in minor civil strife.

Population Distribution by Religious Communities, Nationalities and Migrants and Languages Spoken

Of the total population of 2,548,677, Hindus number 2,125,826, Muslims 305,932, Christians 75,836, Sikhs 14,166, Jains 11,741, and Buddhists 9,427. Together they account for 2,542,928. The remainder (5,749) is made up of Jews (1,935), Zoroastrians (1,623), other religions, atheists, and persons who did not return a religion. The proportion of females to 1000 males among the main religions is, for Hindus 577, for Muslims 398, for Christians 1389, for Sikhs 586, for Jains 568, and for Buddhists 601.

57,470 persons have returned themselves as non-Indian nationals, of whom 41,689 are males and 15,781 females: 32,330 as Pakistani, 8,717 as British, 6,645 as Nepalese, 5,710 as Chinese, 679 as American, 411 as Australian, 316 as Burmese, 265 as American other than United States; 162 as Irish, 146 as Dutch, 133 as French, 132 as Goanese, 125 as Italian, 122 as Danish, 106 as Iranian, 114 as Israelite. Twelve nationalities have returned between 25 and 100 persons each while twenty-six others have returned below 25 persons each. Some are lone representatives of their country.

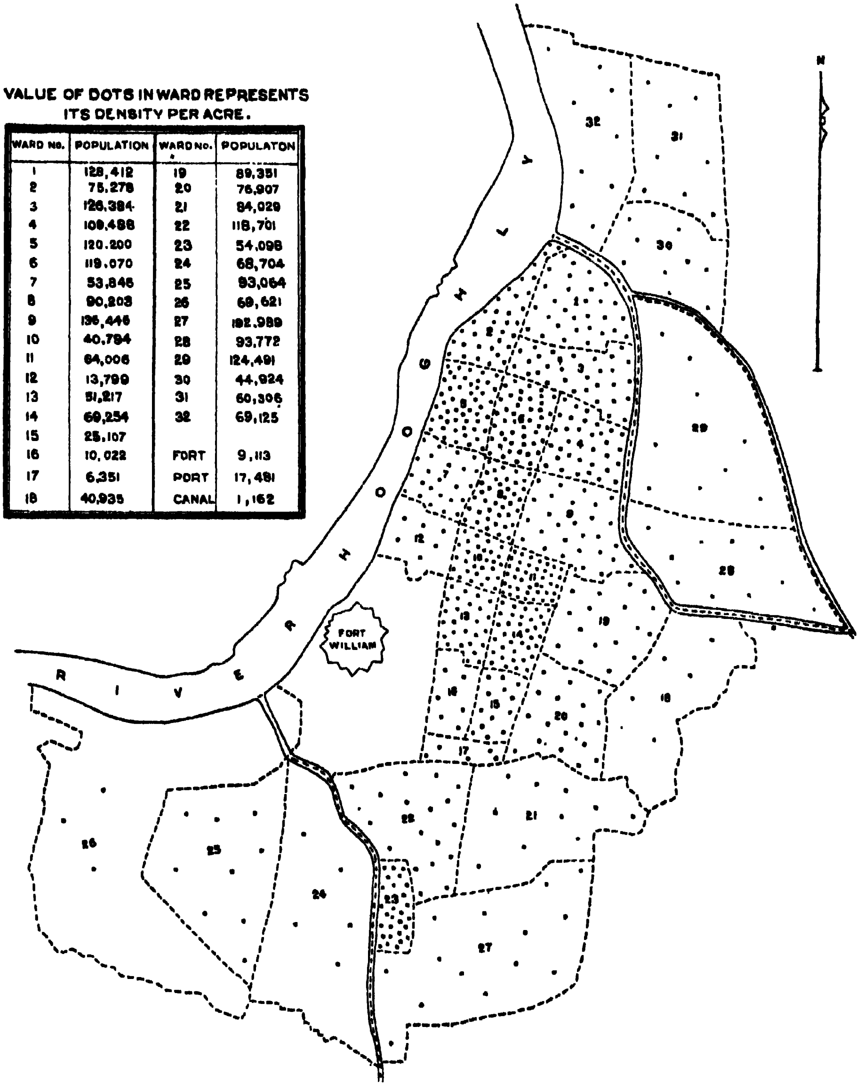
The extent of migrants who have swarmed into Calcutta may be judged from the fact that only 845,055 persons or less than a third (33.1 per cent.) of the total population returned themselves as having been born in the city, another 317,677 (12.4 per cent) as having been born in other districts of West Bengal.

672,548 (26.3 per cent.) persons were born in other States of India, of whom 425,797 (16.7 per cent) were born in the States neighbouring West Bengal. 685,672 persons (26.9 per cent) were born in Pakistan, of whom 433,228 (17 pei cent of Calcutta's population) are now settled as 'displaced' in the city. Excluding those born in Pakistan, the number of persons born in 'countries in Asia beyond India' is 19,710, in European countries, 5,433, in Africa 112, in the two Americas 926, in Australasia 95. The number of mother tongues spoken is 83, of which 30 are non-Indian (not counting English which is the mother tongue of a large number of Indian nationals). Bengali is the mother tongue of 1,670,601, Hindi of 516,953, Urdu of 171,339, Oriya of 57,835, English of 27,228, Gurmukhi of 5,881, Nepali of 16,508 and Gujrathi of 13,533. Another eight languages claim between 2,000 and 10,000 persons each as their mother tongue, and a further nineteen between 100 and 2,000 persons each; the remainder below 100 persons each. 206,467 persons (8.1 per cent of the total population) speak a subsidiary Indian language (English being *omitted* as a subsidiary *Indian* language) besides their mother tongue, the chief subsidiary languages used being Hindi (93,382), Bengali (79,211), Urdu (24,531), Oriya (3,416) and Assamese (1,717). This gives a brief idea of the very complex mosaic that is Calcutta's population.

Distribution by Occupations

No less impressive are the city's occupations. For the purpose of the census all principal livelihoods were divided into two broad classes—agricultural and non-agricultural. Each class was further divided into four categories: the agricultural into (i) cultivators of land wholly or mainly owned and their dependants, (ii) cultivators of land wholly or mainly unowned and their dependants, (iii) cultivating labourers and their dependants, and (iv) non-cultivating owners of land, agricultural rent-receivers and their dependants; the non-agricultural into persons (including their dependants) engaged in (v) production other than cultivation, (vi) commerce, (vii) transport, and (viii) other services and miscellaneous sources. Category (i) claims 4,697, (ii) 309, (iii) 285, (iv) 17,405, (v) 547,262, (vi) 756,168, (vii) 287,681, and (viii) 934,870. In the agricultural occupations (i to iv—22,696) 6,081 were self-supporting persons, 16,280 fully dependants and 335 earning dependants. In the non-agricultural classes (v to viii—25,25,981) 1,106,429 were self-supporting persons, 1,391,232 fully dependants and 28,320 earning dependants. Among self-supporting persons of all categories 76,001 are females (about 3 per cent of the total population) and 4,954 females are earning dependants. The three per cent is significant inasmuch as employment for women except in teaching, midwifery, nursing and domestic service was thrown open in other directions only after the advent of World War II. For each of about 220 occupational groups adopted under the Indian Census Economic Classification Scheme, Calcutta claims a fair number of adherents. Among self-supporting persons engaged in profitable occupations, 52,037 persons returned themselves as employers, 700,104 as employees and 328,208 as independent (on own account) workers. The corresponding figures of self-supporting females are 580,52,051, and 15,146 respectively: a total of 67,777.

A census of small scale industries, that is, those which do not fall under the Factories Act, was taken in the city. 20,575 such industries were found to operate, of which only 98 were handloom establishments employing 301 handlooms and 606 persons. The rest include a very great diversity of small-scale production of food, raw materials and finished merchandise and employ a total of 72,428 persons.



VALUE OF DOTS IN WARD REPRESENTS ITS DENSITY PER ACRE.

WARD No.	POPULATION	WARD No.	POPULATON
1	128,412	19	89,351
2	75,278	20	76,907
3	126.384	21	84,029
4	109.488	22	118,701
5	120.200	23	54,098
6	119.070	24	68,704
7	53,846	25	93,064
8	90,203	26	69,621
9	136,446	27	192.989
10	40,794	28	93,772
11	64,006	29	124,491
12	13,799	30	44,924
13	51,217	31	60,306
14	69,254	32	69,125
15	25,107		
16	10,022	FORT	9,113
17	6,351	PORT	17,481
18	40,935	CANAL	1,162

Density Map of Calcutta: 1 dot = 10 persons.

Communication and Transport

CALCUTTA, the largest city in the East, presents a transport problem which is unique and unprecedented in its character and complexity and can hardly be matched with anything of such problems anywhere in the world. The city proper, which had gone on growing since its foundation somewhere in the late 17th century, lies to the west of the river Hooghly having the form of a ear of corn and extending over a distance of 7 miles from north to the south and 2½ miles from east to west with an empty region 2 miles by 1 mile in the centre—the famous Maidan. In this relatively restricted area, there is a population estimated at 4,000,000 and over. The main suburb is at Howrah which is the great industrial district on the right side of the Hooghly river and is now spanned by a modern bridge of the latest type. With the influx of population from East Pakistan that has gone on for the past 2 years, the suburbs are extending towards the north and south and shadow towns and hamlets are emerging by sheer force of circumstances, not allowing any time for planned development, with a rapidity which is hardly conceivable.

The Dalhousie Square remains the centre of affairs with all the Government offices, General Post Office, banks, insurance offices, railway headquarters offices, Port Commissioners, Customs and commercial houses and is situated in a restricted area with Canning Street to the north, the river to the west, the Maidan to the south and Bentinck Street to the east. To this centre the business men and employees pour from all sides at 10 a.m. each day and leave again at 5 p.m. To the north and east of this zone of attraction, live a considerable part of the population; to the south are also residential districts and beyond this area more densely populated regions extending over 3 miles. Along the river after the Maidan are the Docks of the Port and the districts behind Kidderpore where mostly the dock labour and artisans working for the different industrial factories live.

Tram, Bus, and Taxi Transport

With this geographical area, 3 great axes of circulation have evolved which run (1) *via* Strand Road, (2) *via* Russa Road, Chowringhee Road and Chittaranjan Avenue, with a parallel line running *via* Wellesley Street, Wellington Street, College Street and Cornwallis Street, and (3) *via* Circular Road. These great axes are joined from east to west by numerous transversals such as Grey Street, Harrison Road, Bowbazar Street, Dharamtala Street, Park Street and Circular Road. Two great railway systems flank the city, one at Howrah across the bridge and another at Sealdah, on the two banks of the river Hooghly. The railways were constructed towards the 'sixties of the last century and the tramways were installed as far back as 1880, drawn at first by horses which were replaced finally in 1902 by electricity. Buses were first put into service in 1926 and the number has gone on from a mere handful to almost over a thousand today. Besides there are nearly 30,000 private cars, 1,200 taxis and over 10,000 trucks.

The complexity of the transport problem in the city is enhanced by the existence of antiquated modes of transport side by side with modern means of transport. There are approximately 6,000 rickshaws, and 1,000 horse-drawn cabs still running on the streets of Calcutta and to this must be added over 20,000 bi-cycles and approximately 2,500 private horse carriages. All these go towards making the Calcutta transport problem really an acute one.

Coming to the number of passengers that are daily carried, approximately 350 tram cars carry 320 million passengers a year, while the buses carry approximately 120 million and the railways bring in 75 million passengers each year into the city. If the stable urban population, estimated at 3,200,000, is taken into account, the average co-efficient of 160 journeys a year per inhabitant occurs in this area; and if the journeys made by rickshaws and horse cabs, which are estimated to be 190 million per year, are added, this would give a co-efficient of 200 annual journeys per person as compared with 500 for London, 460 for New York, 438 for Chicago and 400 for Paris.

Such, in brief outline, is the transportation situation of the city of Calcutta as it is today. Effort has from time to time been made to co-ordinate the city transport but no substantial progress has so far been achieved. Very recently a good beginning has been made with regard to the State Transport Organization and as a basis for any sound transport organization, suitable maintenance garages and workshops have just been completed. There are 2 zonal depot-garages now with accommodation for 115 vehicles in each and building of a third subsidiary one is under way. A general workshop attached to the Directorate of Transportation has also been completed and, when fully manned, this workshop will be capable of looking after the entire fleet of buses belonging to the State Transport and also cater for other vehicles belonging to the Government of West Bengal in the various departments, of which the number is roughly estimated at 2,500 to 3,000 vehicles. Approximately belonging to the State Transport 150 buses are operating daily on the streets of Calcutta and this figure is gradually being increased.

In the city privately owned buses which are controlled by a Bus Syndicate operate side by side with the State Transport buses, but from the congestion that goes on day to day there is no doubt that considerable room for expansion exists. Though the public buses have been pioneers in the matter of bus transport in Calcutta, multiple ownership without development of a properly organized unit has gone on for years and it is an extremely difficult task to bring such varied interests into one corporate whole, however therein lies the solution of the problem. It has to be realized also that surface transport in Calcutta has almost reached saturation point and any one watching the movement of traffic at any critical junction point in this city will soon realize this.

Underground Railway and Electrification of Suburban Railways

Possibility of a Paris Metropolitan type of under-ground railway for Calcutta had lately been investigated. These investigations were entrusted to the Paris

Metropolitan Railway Organization and a most valuable report had been obtained, which very definitely indicated that underground railway system was quite a practical proposition in the city. But a project of this magnitude is extremely costly, and the finances of the country do not permit of the project being launched at the present stage. There is also urgent necessity for electrification of the suburban railways coming to the city and a few years back a Terminal Facilities Committee was set up, which recommended a circular electrical railway around the city and electrification of the suburban areas on both system of railway serving the city. The two railway systems are since joined into one now. This scheme is also held up on financial grounds. It is to be hoped that money ere long would be forthcoming for this scheme, which is so vital to the transport development in this area.

Another great handicap is lack of proper outlets from the city. On all sides the outlets form bottlenecks and unless these bottlenecks are removed and easy and quick access to outside suburbs is provided, development of suitable shadow towns and hamlets would be impeded which alone can bring the much needed relief to this great city. The question of improving the outlets is receiving the active consideration of the Government of West Bengal and a committee had been set up to investigate and formulate schemes for clearance of this bottlenecks and providing improved access in and out of the city.

Air Transport

Coming now to air communications, serving the great air-port at Calcutta, one is simply staggered to note the advancement that has been made in air transport in this city in recent years. From May '51 to October '51 the average number of aircraft movements per month at Dum Dum had been 3,565. The average number of passengers per month for the same period had been 30,100. The average mail and freight figures passing through the air-port per month have been 207,000 lbs. and 8,800,000 lbs. respectively.

The maximum aircraft movements in a month had been 4,125 during the month of July '51; similarly maximum number of air passengers in the month of May was registered as 33,974, and 2,037,100 lbs. of mail in the month of September and 10,516,800 lbs. of freight in October. The night air mail service which connects Calcutta with Bombay, Delhi and Madras *via* Nagpur handles on an average 20 passengers per night and 4,456 lbs. of mail and freight.

Some of the important cities in the world to which Calcutta air-port is connected by regular schedule air services are London, Amsterdam, New York, Paris, Oslo, Stockholm, Karachi, Rangoon, Bangkok, Manila, Saigon, San Francisco, Batavia, Mascot, Sydney, Dacca and Chittagong. Within India most of the States and the big cities are on the schedule lines running from this great air-port.

Calcutta Air-port is provided with all the latest navigation facilities enabling aircraft to land at the aerodrome even in very bad weather when visibility is next to nothing. Full facilities also exist for night landing, and electric flare path, taxi track lighting, apron lights and also the flushing beacon of the latest type are all featured in this air-port. The air-port is also provided with all the convenience that air passengers might need at a large air terminal.

Though Calcutta lies on the bank of the Hooghly which is quite navigable for a good stretch, inland water transport is not developed as it should be. Initial enterprises in this direction had been through European companies who have since wound up their business and Indian concerns of sufficient experience have not yet come forward to take their places. Besides, manpower is also to be trained and this has been taken in hand by the Government of West Bengal and it is hoped that ere long an well-organized river transport system will also be available along the river routes of this great city.

Calcutta Improvement Trust

How the Idea took shape

A RESUME of the circumstances which led to the creation of the Trust was given by Hon'ble Mr. Stephenson when introducing the Bill in the then Bengal Council on August 30, 1910. The starting point was the report of the Calcutta Building Commission appointed in 1897 which drew pointed attention to the extent of extreme overcrowding that prevailed in the northern part of the city and recommended the desirability of opening out a number of fairly wide streets traversing these areas as well as open spaces to act as lungs to the locality. In recommending this idea to the Government of India in 1899 the Government of Bengal suggested that the execution of the Improvement Schemes should be entrusted to a separate body or Trust and that the Land Acquisition Act should be amended in certain particulars. An outline of the scheme was published in 1903. The criticisms that followed were considered by an advisory conference which recommended some important modifications. These recommendations were accepted by the Bengal Government and approved by the Government of India, and again published in 1905 for inviting public opinion. After ten long years of gestation the Calcutta Improvement Act was put on the Statute Book in 1911, and a Board was set up in 1912.

Object

The preamble of the Act gives a concise summary of its purpose and defines the scope of the Trust's operations. The purpose is laid down as "the improvement and expansion of Calcutta" and this is to be achieved by "opening up congested areas, laying out or altering streets, providing open spaces for purposes of ventilation or recreation, demolishing or constructing buildings,............ ....rehousing persons of poorer or working classes displaced by the working of the Improvement Schemes and otherwise." It shows clearly that the Trust is not a town planning authority in the modern sense, but an authority charged with the duty of framing and executing schemes of urban improvement of certain specific kinds. These schemes fall broadly into three classes, namely, general improvement schemes, street schemes and rehousing schemes, and the relevant sections of the Act give some idea of the provisions that must be incorporated in such schemes. A street scheme may be framed whenever requirements of traffic or conservancy, or the needs of building sites and improved ventilation justify the laying out of new streets or altering existing ones; but an essential precondition of the framing of a general improvement scheme is a declaration that the area is unhealthy which defect can be most satisfactorily dealt with by framing such a scheme. The stress laid on considerations of health to the exclusion of other factors betrays the origin of the Act, for it is modelled on the English Working Classes Housing Act, 1890, which was passed at a time when questions of urban æsthetics or general convenience, or community centres, or playgrounds and open spaces were still in the background. The Trust was not given any powers of zoning specific areas for definite purposes or compelling the observance of any specific building rules in the areas it has developed and sold to the public. It has no powers of providing housing accommodation except to persons dispossessed by its operations.

Means Provided

The machinery provided is the Board of Trustees for the Improvement of Calcutta. The eleven members of the Board consist of a Chairman appointed by Government, the Chief Executive Officer of the Calcutta Corporation and three members elected by that body, two representatives of the Chambers of Commerce and four nominees of the Government. This Board is assisted by a requisite technical staff and is subject to a loose control by the Government.

The financial provisions, without being generous, are adequate. The five main sources of revenue are—

	Amounts for the year 1950-51
(1) Contribution from the Corporation at 2 per cent of the annual rateable value	*Rs. 20,34,000
(2) Duty on jute exported from the Port of Calcutta	„ 5,39,000
(3) Duty on transfer of property within the Calcutta Municipal area	„ 9,47,000
(4) Terminal Tax on passengers	„ 4,30,000
(5) Government grant	„ 1,50,000
Total ...	Rs. 41,00,000

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* Payment of Rs. 6 lakhs during the year has been deferred.

What the Trust has done

The earliest operations were started in three independent areas, namely, Soortibagan, Shambazar and Wards Institution Street in central and northern Calcutta respectively. These were covered by three groups of schemes I, II and III, which were generally confined to the widening of streets and removal of congestions from overcrowded areas. Preliminary steps in respect of these schemes were taken in 1912, but work was somewhat slowed down on account of the war, and it was not till 1923-1926 that the schemes were really completed. It is noticeable that the recoveries from these schemes exceeded the outlay which probably indicates the cautious attitude of the Trust in the beginning of its activities in providing amenities.

Next to come in for attention was the southern part of Calcutta which was covered by three Schemes IV, IVA and V. The first and the second widened the then Russa Road from Elgin Road to the railway line and the third reorganized the road system in the Bhowanipore area comprised within Elgin Road, Russa Road, Hazra Road and Lansdowne Road. Bhowanipore was already a sewered area, but its roads were narrow and winding and far too inadequate to serve the needs of the people. Scheme V increased the proportion of roads and open spaces from 6 per cent to nearly 24 per cent of the total area ; but the conditions reached were far from ideal. Bhowanipore illustrated the difficulty of improving a heavily built up area and of overcoming influential local opposition which often compelled the Trust to follow the line of least resistance and be satisfied with the second best. The cost of acquisition in this scheme was heavy. The roads could not be straightened and widened to the desirable standard, nor adequate open spaces provided, but even so, the recovery was considerably below the expenditure.

By now the Trust was in a position to undertake the first of the eleven major improvements in Scheme VII group, which between them cover the entire 2⅔ miles of what is known as Chittaranjan Avenue, a single track 100-ft. road connecting the Esplanade with the northern part of the city with its ancillary spurs thrown out to east and west, namely, Chitpur Spur, Vivekananda Road and Jagannath Ghat Road. Preliminary steps were taken from 1914 onwards and the work was done in sections, the earliest of which was completed in 1924 and the latest in 1936. The actual area covered by this group of schemes was 211.1 acres, and they have so far cost the Trust in property acquisition, engineering works and other expenses nearly six crores of rupees, against which there is a recovery of a little less than four crores by sale of land, betterment fees, etc. Improvement of road surfaces is still being made by substituting cement concrete for asphalt, and two important sections (covered by Scheme LVIII and Alignment No. IX) are still to be undertaken before the series can be said to be completed right up to the canal bridge. In the meantime the 84-ft. road known as Bhupendra Bose Avenue (Scheme XXXVII) has been completed to link up Chittaranjan Avenue with Shambazar Circus.

The next group of improvement Schemes (Scheme VIII series) tackled the east central district, formerly known as Karaya Bazar, which was predominantly a slum area and partly inhabited by Calcutta's underworld. The central feature of this improvement is the Park Circus which is a focal point of six roads, of which five have actually been constructed and the sixth is in contemplation. The Eastern Park which is the biggest in Calcutta is partly covered by Scheme VIII and partly by Scheme XXXV. Preliminary work started towards the end of the war, but the work was not completed till 1926. Later experience has shown that it was a mistake to throw large areas into footpaths in Park Street Extension. It narrowed the carriageway over which the tram track has been laid and impeded vehicular traffic. The design of the Circus is also capable of improvement and a scheme for effecting this is being considered.

At a later stage, in order to remove the isolation of this area from the main stream of traffic, two systems of very wide roads were designed to connect it with South Calcutta and Central Calcutta. Scheme VIII-C (Amir Ali Avenue) planned in 1929 and completed in 1936, came only up to Store Road, and Scheme XLVIII sanctioned in 1937, carried it up to Rash Behari Avenue which had already opened up a large part of southern Calcutta. On the other side Schemes XXXV, XLIX and LII carried a 100-ft. dual carriageway road for over two thousand yards till it met Middle Road, Entally at right angles, and Middle Road, Entally was itself proposed to be widened to 100-ft. by a Scheme (No. LV) from this point up to Lower Circular Road at its junction with Corporation Street and Dharamtala. Schemes XXXV, XLIX and LII have been virtually completed and Scheme LV is now under construction.

When the Trust came into existence, the area between Monoharpukur Road and the railway line and Russa Road and Ballygunge Station was low lying marshy jungle profusely dotted with tanks. To all appearance it was a very unpromising material for a potential building site. At the same time it was vital that Calcutta must expand to cater for an increasing population and geographical reason suggested a southward expansion as the easiest way out and the least likely to meet with opposition. The idea was then conceived of acquiring this large tract of land and excavating a lake for the purpose of reclaiming the low lying area. In this way, partly through conscious planning and partly through picking up new ideas as the work proceeded, we got two of the widest streets in the city and also the Dhakuria Lakes which may be described without exaggeration as the most beautiful and popular place of public recreation in Calcutta.

The first three schemes in group XV started in the early twenties and comprised the present Rash Behari Avenue from Tolly's Nullah to the Ballygunge Station. From Russa Road to Gariahat Road it is a 120-ft. wide dual carriageway road with two parks spaced at convenient distances. The subsidiary scheme No. XVD widened and extended the southern portion of Lansdowne Road. About 190 acres of marshy land on the southern fringe was simultaneously excavated for reclaiming about 720 acres of low lying land in this area and the Dhakuria Lake came into existence. To meet the additional requirements of earth as well as to open up further areas for residential purposes Scheme XXXIII was framed. It comprised the western portion of the Lake as well as the western section of the Southern Avenue, while Scheme XLVII covers the eastern section. The width of the Southern Avenue is 150 ft. and the Lake area is probably the most coveted building site for the upper middle-class people in Calcutta. Rash Behari Avenue was completed between 1926 and 1928 and the western section of Southern Avenue was completed in 1937. The main road in the eastern section was completed in 1940-41, but before the ancillary roads were completed or taken up, World War II interfered with the operations and the area was requisitioned for defence purposes from which it has not yet been completely released.

The groups of Schemes (XXVI, XXVII, XXXII, XLII & XLIII) effected considerable improvements in the Barabazar area at enormous cost. Schemes XXXVIII (Mission Row Extension) and XL (Ganesh Chandra Avenue) which pass through a busy commercial area are responsible for opening a broad 84-ft. road between Old Court House Street and Wellington Street. Another outstanding work is the 100-ft. wide Howrah Bridge Approach Road (Schemes XLV and L) which runs over 1000 yards like the arc of a circle and is so designed that heavy commercial traffic from Bowbazar and Dalhousie Square areas may bypass the crowded Strand Road on its way to the Howrah Station. The rapidity with which sky-scrapers are being built on both sides of this road shows that it bids fair to be the busiest commercial centre of Calcutta within a short time.

The biggest undertaking which the Trust has now in hand is the development of Maniktala comprising roughly 7 square miles between the Circular Canal and the New Cut Canal. The area is unsewered and the canals and the railway tracks present an engineering problem in bridge construction which is almost insoluble except at a cost which may run to astronomical figures. The recently sanctioned revised proposal of having two sewers of smaller size discharging at two points, instead of one big diameter interceptor sewer discharging at the Dhappa Pumping Station will reduce the expenditure and expedite the work considerably. When the sewers are laid and the 100 ft. and 120-ft. roads are constructed, a very large and unhealthy area will be reclaimed for residential and industrial sites. As in South Calcutta, lakes figure prominently in the schemes and have an independent æsthetic value of their own, apart from their utilization value as the source of the much needed 30 million cubic feet of earth.

As Calcutta is almost surrounded on all sides by canals and water courses, the Trust had to erect a number of substantial bridges providing maximum clearance for canal traffic and designed to the standard loading of the Ministry of Transport in U.K. Up to the present the under-mentioned canal projects have been erected:—

			Cost				Cost
1.	Dum-Dum Bridge	Rs.	5,75,526	5.	Narkeldanga Bridge	Rs.	5,26,562
2.	Maniktala ,,	,,	5,97,220	6.	Chitpore ,,	,,	1,96,052
3.	Alipore ,,	,,	3,54,713	7.	Tollygunge ,,	,,	2,46,957
4.	Beliaghata ,,	,,	5,29,815	8.	Barrackpore ,,	,,	3,97,403

The Belgachia Bridge now under construction by the Government of West Bengal over the railway line is estimated to cost about Rs. 27 lakhs and the Trust is committed to a contribution of Rs. 12 lakhs. There are seven other bridges over railway lines and two over canals which have to be erected to facilitate movements into and out of Calcutta and the estimated cost varies in each case from Rs. 10 lakhs to Rs. 20 lakhs.

This section may be concluded by a reference to the open spaces which are the essential lungs of a city like Calcutta, but whose provision becomes extremely difficult on account of high land values. Up to the present the Trust has laid down and developed 38 parks and open spaces covering an area of about 318.58 acres. The largest of them, the Dhakuria Lakes (190.74 acres), and six other small parks and squares are still under the control of the Trust; but the other 31 have been made over to the Corporation. Three of them, namely, Cossipore Chitpore Open Space (51.57 acres), Eastern Park (24.57 acres) and Deshbandhu Park (17.52 acres) are quite substantial in size. Quite a large slice of Maniktala has been earmarked as open space and lake and will be a great attraction when it is developed. The dearth of children's playgrounds in Calcutta has led the Trust to utilize and equip for this purpose lands which have been acquired in alignments but which are not likely to be converted into schemes for some time to come. This has added another 24 children's corners to the city's inadequate total.

Conclusion

In reviewing the work of the Trust, achievements have been dwelt on. To avoid a charge of bias, its failures should also be mentioned.

Hitherto the major stress has been laid by the Trust on the problem of traffic and communication. It is high time that attention was paid to the problem of bustees and rehousing. Slum improvement which was the intention of the abortive Slum Improvement Act of 1945 would have only tinkered with the problem. The real remedy is acquisition of all interests in the bustee areas, filling up all the insanitary tanks and raising suitable building blocks for the accommodation of the displaced people.

To what extent the activities of the Trust are responsible for raising land values in Calcutta it is difficult to say. The Trust simply improves the quality of the land, but the land value is determined by the forces of supply and demand, and as more people are anxious to purchase lands from the Trust than from private parties, the prices of Trust lands are higher in comparison. But this very fact tends to some extent to produce a result, e.g. overcrowding, which it is the avowed object of the Trust to eliminate. When men pay heavily for land, they naturally want to utilize every inch of space profitably—and profit in such circumstances is generally equated with a money return.

When the C. I. Act was passed, the areas surrounding Calcutta were comparatively unspoilt. It would have been better if provision was made in the Act, as was at one stage the intention, for powers to acquire large tracts outside the municipal limits and lay them out in convenient blocks for the reception of surplus population ousted from the centre. That would have enabled the creation of a green belt round Calcutta and the setting up of a number of satellite or dormitory towns acting as feeders to the metropolis. In the absence of such a provision and with the introduction of fast moving transport, the rapidly increasing population has settled itself chaotically in the hinterland which is responsible for the haphazard growth of a vast urban sprawl where mansions live in uneasy alliance with slums and factories impinge on good class residential areas without compunction on one side or protest from the other. Greater Calcutta has already become a unit for certain purposes, for example, drainage and communication, and it should be so planned as to allow a more rational distribution of industries and population. Ribbon developments on all the roads leading out of Calcutta are shocking to a degree. They are a danger not only to ordinary pedestrian or vehicular traffic, but also to army movements in case there is a major conflict with an outside Power. A town and country planning authority with adequate powers and finance is the only instrument which can undo the mischief already done and prevent further mischief.

City's Power Supply

THE passing of the "Calcutta Electric Lighting Act" in the year 1895 may be said to mark the beginning of the electricity supply in Calcutta. The first licence under this Act for supply of electricity in the central part of Calcutta was granted on January 7, 1897 to the Indian Electric Company Limited which soon after came to be known as the Calcutta Electric Supply Corporation Limited.

The Calcutta Electric Supply Corporation has during the period of over 50 years catered for the supply of electricity in Calcutta and its surrounding districts.

Calcutta, the then capital city of India, had the privilege of being the first metropolitan city to have public supply of electricity, and the supply of electricity was actually commenced on April 17, 1899.

The area within which the supply of electrical energy was permitted under the first licence was 5.46 sq. miles. To serve this area a single power station was set up at Emanbagh Lane with an installed capacity of 1,000 kw. of generating plant.

In those days electricity was practically synonymous with electric lights, and the capacity of the generating plant set up in the first generating station was estimated on the basis of the probable lighting loads that might come on the system. The usefulness of electric fans was soon appreciated and fan loads also began to grow.

Within a short period, the capacity of the generating station proved inadequate for meeting the growing demand for supply and distribution throughout the then area of supply, and two more generating stations, one at Alipore and the other at Ultadanga, with generating plant capacity of 750 kw. and 1,200 kw. were set up in the years 1902 and 1906 respectively, with a small station in Howrah in 1906.

The supply of energy was then on the direct current three-wire system at a voltage of 450 volts and 225 volts. This system of supply is maintained even at the present time in the central part and also in certain northern and southern areas of Calcutta.

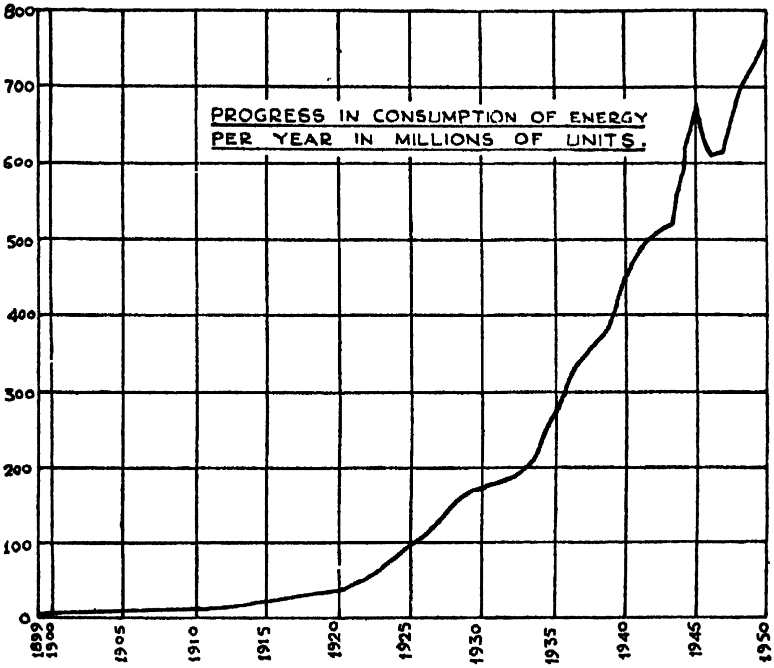
The foundation of the present-day system throughout the area of supply which has now extended to cover more than 540 sq. miles, in which is included the whole of Calcutta as also other neighbouring areas extending on both sides of the river Hooghly, was laid with the commissioning of the Central Power Station at Cossipore in the year 1912. Under this scheme, electricity was generated at 6,000 volts on the alternating current system and the energy so generated was distributed throughout the area of supply through a number of converting and transforming sub-stations. This marked the beginning of the increased use of electricity for industrial motors and for other purposes. The growth and prosperity of the industrial undertakings in and around the city of Calcutta may be said to be largely due to the early and reliable supply of electricity in sufficient quantity and at reasonable rates.

With the growth in the demand for power supply and increase in the area of supply, two more Generating Stations, one at the southern end of Calcutta and the other at Mulajore in the northern suburbs of Calcutta for generation of electrical energy at high pressure, were gradually set up. Until recently, these three Steam Power Stations known as the Cossipore Power Station, Southern Generating Station and Mulajore Power Station, all situated on the eastern bank of the Hooghly over a length of some thirty miles, met the entire power requirements of Calcutta and the surrounding districts. These generating stations are electrically tied together at 33 kw. in order that the power resources can be pooled for efficient supply and distribution.

The inauguration of the new Cossipore Generating Station on January 4, 1950, which will eventually replace the existing Cossipore Generating Station, marks a further progress in the development of electricity supply in Calcutta. This new generating station is an imposing structure rising to a height of some 130 ft. and covering a floor space of 101,500 sq. ft. and is designed for an ultimate capacity of 210,000 kw. One 50,000 kw. and two 30,000 kw. generating sets have already been brought into commission and are contributing to the power resources of the other stations. The total effective generating plant capacity in these generating stations amounted to 418,000 kw. at the end of 1950.

The power supply from these generating stations is distributed throughout the entire area of supply extending over an area of 540 sq. miles at 20,000 volts, 6,000 volts and at 3,300 volts on the high pressure system, while on the medium and low pressure systems of supply energy is delivered at 400 and at 230 volts on the A.C. and at 450 and 225 volts on the D.C. system.

For the purpose of distribution there are now a total of 115 transforming and converting sub-stations and energy at different voltages of supply is distributed through an extensive and complicated distribution net-work comprising approximately 1,600 miles of underground cables, both H.T. and L.T. and 550 miles of low-voltage overhead lines.



Units of Energy in millions
Year (1899—1950): (By courtesy of Messrs. C.E.S.C.)

Over 500 high pressure consumers and 146,301 medium and low pressure consumers are at present supplied with energy from the Calcutta power supply system, and the total connected load on the system was 549,675 at the close of 1950. During the year 1950, a total of 893,318,900 units of electrical energy were generated, out of which 763,894,679 units were actually consumed by the various categories of consumers. The use of A.C. power is by far the greater than that of D.C. power, and at present about 25 per cent of the total units generated is consumed on the D.C. supply system. The graph indicates the manner in which the use of electricity has grown since the commencement of supply of electricity in Calcutta.

In recent years there has been an enormous increase in the demand for electricity. The maximum demand on the supply system which was 157,000 kw. in the year 1947 has gone up to 246,000 kw. in 1951. Of the total maximum demand, on the high pressure systems of supply, some of the heavy industries like the jute mills account for nearly 85,250 kw., cotton mills for nearly 9,680 kw., engineering industries for nearly 27,650 kw., pumping for nearly 9,500 kw.

while tramways account for nearly 8,640 kw. Other industries and high pressure consumers account for nearly 40,000 kw. of load.

Electricity is no longer a luxury for the few. Its diverse and manifold uses both for domestic purposes and for industrial and other requirements, have made electricity an indispensable necessity for the well-being of the community life in a metropolitan city like Calcutta. The city's supply system may be said to have rendered excellent service towards these ends during the last 50 years.

City's Water Supply

THE water supply for the city of Calcutta is featured by a dual system of supply, (*i*) filtered for domestic purposes, and (*ii*) unfiltered water for fire fighting, street watering and flushing of closets into sewers.

The first effort to supply water to the citizens which dates back to 1820 was by installing a small pumping plant at Chandpal Ghat near the High Court for lifting water from the Hooghly and distributing it through open masonry aquaducts by gravitation over a small portion of the town. The supply of pure water was recognized as a legal obligation by provision made in Act VI of 1863 and the first scheme for supply of filtered water was executed between 1867 and 1869. Both the systems have been maintained and have developd gradually.

Intake for Filtered water at Pulta

The source of supply is the river Hooghly and the intake is situated at Pulta near Barrackpore 18 miles above Fort William along the river. The place was selected as it was "above the influence of salt water except perhaps occasionally at extraordinary high tides about the time of vernal equinox". Although there has been increase of salinity in the river water at the intake in recent years, it cannot be said that the quality of water has deteriorated. The chemical constituents of the river water analyzed in the Pulta Laboratory during 1950 will give an idea of the character of water. The results are in parts per million.

		Max.	Min.
Turbidity ...	... 3,600	(June)	40 (Dec.)
Dissolved Solid	... 1,126	(June)	70 (Oct.)
Alkalinity ...	... 282	(Jan.)	58 (July)
Chloride ...	... 500	(June)	4 (July)
Total Hardness	... 286	(May)	46 (July)
Permanent Hardness	... 20	(May)	Nil
Oxygen Consumed	... 5.93	(May)	1.35 (Feb.)
Dissolved Oxygen	... 8.99	(Jan.) at 20°C	3.92(May) at 32.5°C
*p*H ...	... 8.5	(June)	8.44

Settling Tanks

The river water is pumped into four presettling tanks which have a total capacity of 84 m.g.d. The raw water is treated with alum solution containing 14%—15% of Al 203 and 05% of Fe 203 before it enters the tanks. Each leads into a large settling tank of 200 million gallon effective capacity. The water has to travel over a distance of more than 7,000 ft. before it enters the filters. The period of retention in the settling tanks extends over 2½ days by which time the turbidity in the water drops down considerably and stands between 35 to 20 p.p.m., being high during the monsoons and low in the winter.

Slow Sand Filters

After settlement the water is filtered through slow sand filters of a total capacity of 99 million gallons a day. There are 59 such filters or 90 filter units, each filter unit being 100 ft. x 200 ft. designed to filter 1 million gallons a day. The filtering medium is composed of river sand for a depth of 27″ to 30″ on top, 4″ Magra sand and 5″ gravel at bottom. The effective size of sand varies from 0.2 mm to 0.3 mm.

Rapid Gravity Filters

A battery of 12 rapid gravity filters of Jewell type of a total capacity of 18 million gallons a day has lately been installed and is in commission since April 1951. Each filter has a bed of sand 30″ deep of 0.5 mm effective size supported on gravel arranged in ascending sizes varying from Pea to 2½″ for a depth of 18″. A small dose of alum has to be added for formation of a layer of floc over the sand. The rate of filtration in the rapid filters is 50 times faster than that in slow sand filters.

Prior to the installation of the rapid gravity filters the daily supply of filtered water was 73 to 72 million gallons although the maximum capacity was 84 million gallons a day. The supply of 73 or 72 million gallons could not sometimes be maintained during the mid-summer and the advent of winter when the filters got chocked due to appearance and growth of algæ in the large settling tank. The supply came down to 60 million gallons or even less. It has, however, been possible to maintain a steady supply of 80 million gallons a day after the installation of the rapid gravity filters since April 1951.

The following will give an idea about the characteristics of Calcutta's filtered water:

Turbidity	...	...	...	0.4 to 0.6 p.p.m.
Iron	...	...	...	0.05 to 0.1 ,,
Chloride	...	...	...	200 to 4 ,,
*p*H	...	...	...	8.1 to 8.3 ,,
Odor	...	...	...	Nil

Distribution from Talla

After filtration, the water is chlorinated and pumped to Talla where it is stored in two underground reservoirs of 10 million gallons and 8 million gallons respectively and an elevated steel tank of 9 million gallons capacity standing at a height of 110 ft. above ground. Talla is situated at the northern end of the city. The distribution which radiates from Talla has been designed on a zonal system dividing Calcutta in 4 zones. Cossipore in which Talla is situated has a separate distribution main of its own.

The supply to the city is intermittent. A pressure of 100 ft. is maintained at Talla for 4½ hours in the morning from 5 a.m. to 9-30 a.m. and 2¼ hours in the afternoon from 3-30 p.m. to 5-45 p.m. Further supply at a reduced pressure of 65 ft. at Talla is maintained for 3½ hours from 12 mid-day to 1 p.m. and from 9 p.m. to 12-30 a.m. A pressure of 10 ft. is maintained for the rest of the hours in order to keep the mains charged. The filtered water is again chlorinated at Talla so that there is a residual chlorine of 0.2 to 0.15 p.p.m. when it leaves Talla.

The Corporation had long hoped that with adequate control it would be possible to maintain a continuous supply at a minimum terminal pressure of 40 ft. —a statutory obligation provided in the Calcutta Municipal Act. It had not been possible to do so when the MacCabe Scheme was completed in 1911, neither it had been possible after the completion of the Moore and Bateman Scheme in 1931, nor it has been possible after the rapid gravity filter has been put into commission in 1951.

Scheme for Augmentation of Supply

In 1945, the Government of Bengal (undivided) appointed a Committee of Engineers to examine the question of augmenting the water supply of the city. In a short term scheme, the Committee recommended a supply of 132 million gallons a day of filtered water for an estimated population of 35 lakhs in 1956 in addition to 12 million gallons of water for all purposes to be supplied from deep tube wells in Manicktala area. The Corporation have carried out some of the works recommended in the scheme and have taken up a few others. It has already been stated that a rapid gravity filter of 18 m.g.d. capacity has been constructed. One electric pump of 2 m.g.h. capacity has been ordered for from Germany and will be installed at Pulta P.S. Two others of the same capacity have just been ordered for from the same firms in Germany for Talla P.S. After the installation of these pumps which is expected to be done within the next year, the Corporation will be in a position to supply 90 million gallons a day of filtered water to the city.

Unfiltered Water Supply

Unfiltered water supply is made from two electric pumping stations from the Hooghly within the city at Mullickghat near the Howrah Bridge and at Watgunge near the Kidderpore Docks. The water is pumped directly into the mains for supply to consumers reserve tanks for privy flushing and through ground hydrants in the mains for fire fighting and street watering. The total quantity supplied is about 80 million gallons a day. Although the use of unfiltered water for purposes other than what are specified is prohibited, "it is well known that many houses in Calcutta have unauthorized taps delivering unfiltered water which is used for bathing, washing utensils and other purposes". The unfiltered water supply stands as a supplement to the filtered water supply and it had not been possible to discontinue it so far although all experts investigating the water problems of Calcutta in the past recommended discontinuance of unfiltered water supply for its unhygienic aspects.

City's Health Organization

FOR convenience of administration the municipal city of Calcutta is divided into 6 districts, 4 major districts—districts 1, 2, 3 and 4 and 2 minor ones, —Manicktala and Cossipore districts. The Health Officer is the head of the health organization of the city and he exercises supervisory control over the six districts, each of which is under immediate charge of a District Health Officer. The District Health Officers are primarily responsible for sanitation in houses, regulation of offensive trades, food and drug control and field work in combating spread of epidemic diseases under the direction of the Health Officer. The Health Officer controls directly the other aspects of public health work, including organization for epidemic work, ambulance service, medical relief and maternity and child welfare work.

The different classifications of the organization as detailed below are directly under the Health Officer.

Control of spread of Infection

Small-pox and cholera are two of the dangerous scourges of the city and they usually rage in epidemic forms during the first half of the year. The Corporation maintains a permanent skeleton staff of 60 vaccinators, 16 doctors (assistant sanitary officers) and 9 disinfecting inspectors with coolies for purposes of vaccination, inoculation and disinfection throughout the year and increases the strength as and when the necessity arises.

Hospitalization of the Infected Sick: The Corporation has, unfortunately, no infectious diseases hospital of its own but had been trying to acquire a suitable site for location of the hospital, when, a few years ago, the State Government stepped in and decided to open an infectious diseases hospital for the Calcutta Corporation and other riparian municipalities. The matter is being dealt with by the Government of West Bengal. At present the Corporation discharges its obligation of segregating the infective sick by providing 126 cholera beds and 164 small-pox beds in different hospitals by making it a condition of annual grants given to the majority of these institutions. During the period when cholera and small-pox are prevalent in epidemic form in the city, Corporation has to arrange extra beds on payment of extra sums.

Preparation of Lymph and Vaccine: The Corporation Vaccine Institute prepares vaccine lymph, sufficient for the city's normal requirements. The attached laboratory is primarily meant for bacteriological examination of the lymph according to prescribed standards and also for preparing cholera and typhoid vaccines. The major part of our requirements for cholera and typhoid vaccines for meeting epidemic outbreaks is, however, met by local purchase.

Steam Disinfection: The Central Disinfecting Station has a steam disinfecting plant for treating infected articles free of cost.

Control of Mosquitoes: The Mosquito Control Department is in charge of inspecting premises to detect breeding of mosquitoes, of carrying out anti-mosquito measures and of making a mosquito survey of Calcutta, etc.

Central Laboratory: The Central Laboratory (with 1 chief analyst and 11 assistant analysts and bacteriologists) performs the dual function of (*i*) analyzing the samples of food and drug collected by the food inspectors, and (*ii*) examining the samples of filtered water from the Talla Reservoir, city-mains, house-taps, etc. There are also 3 analysts and 1 chemist in the branch laboratory at Pulta, the site of the water works of the city, where regular daily bacteriological and chemical examination of the water is done.

Statistical Section: It keeps a tag on the growth of epidemic diseases in the city and compiles various tables of vital statistics on a weekly, monthly and yearly basis.

Medical Relief

Hospitals and Dispensaries: The Corporation maintains 19 outdoor dispensaries, one homeopathic, one uani and the rest allopathic—some like those at Pulta and Talla mainly for the local Corporation employees, others at different parts of the city for free treatment of all patients. The average daily attendance ranges from above 400 (in Pulta and Talla Dispensaries). The Corporation also runs a miniature hospital at Mansatala, Kidderpore, with 20 beds for non-infectious cases, and arrangements have been made for opening a "Chest Clinic" at the Mansatala hospital.

Ambulance Service: The Corporation maintains a fleet of 16 ambulance cars for infectious and non-infectious cases.

Maternity and Child Welfare Work

Maternity Homes (Hospitals): The Corporation runs 4 maternity homes of their own. The total number of normal maternity beds in the Corporation hospitals is 134, but due to heavy rush of patients, a large number of extra beds have to be maintained for greater part of the year.

Maternity Units: There are 8 maternity units, covering the whole of the city area, from which qualified lady visitors and nurses pay domiciliary visits to the houses of the poor and undertake delivery cases there.

Training of Midwives: The midwives' training class in the Baldeodas Maternity Home was opened in 1926.

Milk Kitchen Centres: There are 23 milk kitchen centres, at each of which milk is supplied to 40 deserving babies up to the age of 2½ years.

Besides maintaining the above mentioned institutions for medical care of the sick and maternity and child-welfare facilities for the needy persons, the Corporation also arranges for these services by award of suitable annual grants to almost all charitable dispensaries, hospitals, maternity and child welfare centres to the tune of Rs. 8 lakhs annually.

Registration of Births and Deaths

There are 21 birth registration stations in the city for registering the births taking place within the city limits and 14 death registration offices at the burning ghats, burial grounds and crematoria for registering the deaths of persons brought for disposal at those places.

Services through the District Health Officers

Improvement of Sanitation: The sanitary officers for the whole city number 20. They are all medical graduates. They enforce compliance with the provisions of the Calcutta Municipal Act for maintenance of sanitation in houses, to regulate offensive trades, etc.

Control of Food Drug and Meat: There are 30 food inspectors (including 1 for tea only) to look after the purity of articles of food and drug offered for sale to the public and to enforce sanitation of eating-houses, restaurants, etc.

There are 3 meat inspectors with G.B.V.C. qualification, who, assisted by the food inspectors, are in charge of the meat exposed for sale.

There are five slaughter houses under the Corporation, one for slaughter of pigs, three for slaughter of sheep and goats under the District Health Officers, and one at Tangra, under the Health Officer for slaughter of sheep, goats and cattle. The slaughter houses are in charge of qualified veterinary doctors (except one where the market superintendent is in charge) who examine the animals before and after slaughter.

Control of Spread of Infection Field Work: The assistant sanitary officers (all doctors), the vaccinators and the disinfecting inspectors work under the immediate control of the District Health Officers. The assistant sanitary officers occupy the pivotal position in the field work. For all deaths registered at the places of disposal, cards are prepared and sent to the respective districts. The disinfecting inspectors arrange for immediate disinfection, wherever necessary.

Then the A.S.O.s verify the cause of death and arrange for preventive measures where required. These death-cards are used by the statistical section for preparation of mortality statistics.

SECTION II

EDUCATION & RESEARCH

1. GENERAL

Primary and Secondary Education in West Bengal

Primary Education

THE beginnings of popular education in India, and for that matter in West Bengal, are interesting. The work of founding primary schools for the masses was at first left to voluntary agencies, Government having withdrawn from the field as a matter of policy as it was thought that the production of an educated class through whom knowledge was to filter down to the masses was the most essential pre-requisite for the establishment of a system of popular mass education. When these high hopes in this regard were not realized, the Government decided that the responsibility of providing education to the masses should be divided between the local bodies, *viz.*, the district boards, the municipalities and private agencies. Accordingly, the local Self-Government Act of 1884 and the Bengal Municipal Act of 1885 conferred very wide powers upon the district boards and municipalities in the matter of control and administration of primary education. Primary education in this State was thus mainly the concern of district boards and municipalities who were responsible for its administration and the provision of schools in the areas under their control. The only primary schools maintained by Government were practically schools attached to training schools for primary school teachers. The inspecting officers of the Department of Education used to make grants to only a few schools direct, although their authority to inspect every primary school and make recommendations for grants within their administrative jurisdiction was undisputed. Although Government did not take any direct responsibility, they gave grants to these local bodies to help them in their programme of work. But unfortunately no appreciable progress in the domain of primary education was made within a reasonable period of time. It was found that these local bodies were not developing a higher sense of civic responsibility in educational administration. In order to improve the position, the Bengal Primary Education Act of 1919 was passed, empowering municipal authorities to impose education cess and tax within their administrative jurisdiction so as to find money to make primary education free and compulsory in urban areas. But this Act practically remained inoperative in Bengal as option to introduce compulsion was left with these local bodies with the result that very few municipalities except Chittagong, Berhampore and the Corporation of Calcutta availed themselves of the provision of the Act for the introduction of a compulsory system of elementary education in their areas.

Subsequently in 1930 another Act for rural areas known as the Bengal (Rural) Primary Education Act of 1930 was passed, in terms of which District School Boards were formed in districts having full control over primary education in rural areas. This Act is now under operation and District School Boards have since been established and are functioning in all the districts of West Bengal excepting Cooch Behar which has recently merged with the State of West Bengal and the district of Darjeeling where the District School Board is being formed.

The functions of a District School Board are not merely to see that primary education is made free for all boys and girls of the school going age (6—10), but also to make it ultimately compulsory. The Act was not extended so energetically in the beginning as it should have been after it had been placed in the statute book. It has taken over two decades to bring it into full operation, and yet all the districts have not been brought under the Act. This is the reason why a central directive authority which the 1930 Act contemplated by the establishment of a Central Primary Education Committee has not been formed.

Children in rural areas now receive primary education free under the management and supervision of the District School Boards which are ultimately controlled by the Government through the Education Directorate, and the Inspectorate, the members of which act as liaison officers between the Provincial Government and these local bodies.

A thorough and complete reorganization and reorientation of the system of primary education in the State is now contemplated by means of the establishment of a net work of craft-biased activity schools of the junior basic type for which a new curriculum has been constructed and approved by the Government. The fundamental concept of basic education is that education must not only centre round some activity but that such activity must also be related at the same time to the interests of children and the basic occupation of the community so as to release the creative energies of children along channels of productive and socially useful activities. The District School Boards have accepted the new Primary (Junior Basic) Education Scheme approved by the State Government and have also helped to set up so far 92 junior basic schools sponsored by the Government. The State have now decided to introduce gradually and systematically free junior basic (primary) education for pupils of the age-group of 6-11 to complete the first stage of basic education. It is accordingly proposed to recondition the existing set-up of primary schools of the State with a view to fitting them into the new system of craft-biased activity schools as early as its resources permit. Each school will have 5 classes with an ultimate enrolment of 150 pupils and 5 teachers for whom free residential accommodation within the school premises will be provided. A new type of teachers· trained on basic lines in as many as 12 basic training schools (Government and Government sponsored) is taking up the work of teaching in the newly established junior basic schools.

A ten year plan for the introduction of compulsory primary education in rural areas has already been prepared and 1/10th of the rural areas under the District School Boards has already been brought under the operation of this scheme during the year 1951.

Primary education in West Bengal is now a co-operative venture between the States and the District School Boards.

The statistics below will show the number of schools, the number of teachers employed and education cess and Government grant now utilized for the maintenance of these schools.

1.	Number of primary schools	14,767
2.	Number of teachers	42,112
3.	Education cess	43,61,742
4.	Government grant	89,25,029

The scales of pay of teachers in District School Boards schools are as follows:—

Category A—Trained Matriculate	Rs. 35—1—40 + Rs. 5 Head teacher's allowance.
Category B—Trained non-Matriculate and untrained Matriculate	Rs. 30
Category C—Untrained non-Matriculate	Rs. 20

Over and above this the teachers get dearness allowance at the flat rate of Rs. 5/8/- per month.

As regards the city of Calcutta, the responsibility for the introduction of free and compulsory education rests with the Corporation of Calcutta. They maintain about 200 primary schools and have introduced compulsory education in ward No. IX for all boys and girls between 6 and 10 years of age in accordance with the provisions laid down in the Bengal Act of 1919. The teachers are well paid compared to their brethren in rural areas and the Corporation maintains an Education Department for the proper management of such schools in the city of Calcutta. Government also make grants to schools not under the direct management of the

Corporation through their inspecting officers. The statistics below will show the expenditure of the Government in primary education in the city and number of teachers maintained in the aided primary schools:—

1. Number of primary schools maintained by Calcutta Corporation	214
2. Number of primary schools aided by Government	247
3. Amount of Government grant paid ...	Rs. 2,10,067
4. Number of teachers in aided schools ...	837

Secondary Education

Secondary education in this country is generally imparted through two types of institutions, namely high schools and middle schools including extended M. E. schools. 27 high schools and 3 M. E. schools are managed by Government. The rest are under the management of private persons.

The schools are mostly established and run by local people through the agencies of managing committees. The high schools have so long been recognized by the University of Calcutta and the middle schools by the inspecting officers under the control of the Education Directorate. Government used to distribute grants to the schools through the Inspectorate under the control of the Director of Public Instruction of West Bengal. Some schools used to receive grants from the municipalities or the district boards.

The year 1948 saw the beginning of a planned and concerted action towards reconditioning the existing system and revised grant-in-aid rules for high schools were framed. According to these rules Government took up the responsibility of meeting the deficit in running the aided schools. Schools were classified according to roll strength; rates of tuition fees and percentage of free-studentships were fixed and time scales of salaries to teachers were introduced. Lower rates of tuition fees and higher rates of free-studentship in high schools in rural areas were prescribed. Now in rural areas 20% of students of an aided high school read free.

The Calcutta schools are generally financially well off owing to the large number of students receiving education in these schools. But most of them (excepting the Government managed and missionary schools) are badly cramped for space. The number of schools has not increased in proportion to the increase in enrolment as a result of which there is unusual congestion almost everywhere.

In Calcutta there are 111 high schools for boys and 55 for girls of which 5 boys' schools and 2 girls' schools are Government managed. The number of recognized middle schools for boys are 15, including 2 Government managed, and for girls 10.

The number of pupils in these high schools for boys and girls are 83,679 and 29,368 respectively and those in middle schools are 3,018 and 1,722 respectively. The enrolment in secondary schools shows an increase of 10,467 boys and 5,946 girls over the figures of the previous year.

The high schools for boys and girls in Calcutta are staffed by 3,811 teachers and the middle schools by 183, as detailed below:—

	Men	Women	Total
1. High Schools ...	2,770(595)	1,041(557)	3,811
2. Middle Schools ...	190(22)	74(53)	183

The figures in paranthesis indicate number of trained teachers. The percentage of trained teachers is much higher in the case of women than men.

Besides, there are 10 Anglo-Indian schools in Calcutta, 9 of which are aided —2 for boys and 7 for girls, 1 is for boys and unaided. While the number of pupils in the aided boys' and girls' schools is 950 and 2254 respectively, the number of pupils in the unaided boys' school is 1155. Generally the schools with better resources prepare children for the Cambridge School Certificate Examination and others for the Modern Schools Final Certificate Examination which is conducted by the Educational Department of West Bengal. It is recognized as the equivalent to Matriculation by certain Government Departments, Central and State, and other employers, but not by the Universities. Some of the schools were permitted to affiliate themselves for Matriculation as well and they now come under the Board of Secondary Education, West Bengal. These schools are no longer confined to Anglo-Indian children; the proportion of Indian children will soon be at least 40% in most of the schools in the near future.

There are altogether 21 Anglo-Indian schools in this State. Of these 2,1 for boys and 1 for girls both at Kurseong are managed by Government of India and 16 are aided by this State.

With the passing of the West Bengal Secondary Education Act, 1950, the entire structure of the administration and control of secondary schools has undergone a thorough change. The Secondary Education Board have been vested with wide powers in terms of the Act to direct, supervise, develop and control secondary education in the State. They have started functioning and have taken over the control of secondary education in the State of West Bengal. It is hoped that they will bring about desirable changes in the domain of secondary education. The Matriculation Examination of the Calcutta University is being replaced by the School Final Examination of the Board with effect from 1952 and the secondary curriculum is already under examination. Provision will be made for different types of secondary schools suited to the varied needs of different children. Government have placed Rs. 30,00,000 at the disposal of the Board.

The following will show the gradual increase in expenditure on account of maintenance grants to secondary schools excluding Anglo-Indian schools in the State:—

	1947-48	1948-49	1949-50	1950-51
Grants	Rs. 8,60,000	Rs. 12,02,000	Rs. 27,24,000	Rs. 29,14,000

The total number of schools, aided and un-aided for the corresponding years are as follows:—1947-48=1839; 1948-49=2027; 1949-50=2068; and 1950-51 =2275. The figures do not include Government and Anglo-Indian schools.

Growth of University Education—Calcutta University

Early Beginnings of English Education in Calcutta

THE history of the present system of education obtaining in this part of the Indian sub-continent, and for that matter throughout India, which is largely modelled after the Western system of education, spreads well over a century and a half. During the early phase of the East India Company's administration, British opinion regarding the desirability of introducing the Western educational system was sharply divided, even somewhat antagonistic to any such idea. At the Parliament debate of 1793 on the question of the renewal of the Company's Charter in India, one of the Directors of the Company is reported to have observed that 'they (the British) had just lost America from their folly in having allowed the establishment of schools and colleges and it would not do for them to repeat the same act of folly in regard to India'. With the growing experience of administration and of the land and the people, the Company woke up to the need of introducing and establishing Western system of education and gradually adopted an educational policy which made possible the development, for good or evil, of the present system. At the beginning of the nineteenth century, Charles Grant, one of the Directors, was able to recommend in a memorandum the introduction of English education saying that '....the Hindus would, in time, become teachers of English themselves; and the employment of our language in public business, for which every political reason remains in full force, would, in course of another generation, make it very general throughout the country'.

The next stage in the development of English education was set by Minto, Moira and Rammohan Roy. In his famous minute of 1811, Lord Minto drew attention to the poor state of education in literature and science and to the need of improving instructions in them and of setting up newer institutions. Shortly after this a clause was introduced in the Company's Charter, providing that 'a sum of not less than one lakh of rupees in each year shall be set apart and applied to the revival and improvement of literature and for the introduction and promotion of knowledge of the sciences among the inhabitants of the British territories in India'. Lord Moira dissatisfied with the small number of institutions and their tuition made a strong plea for improvement and diffusion of education in places long deprived of this benefit. Notwithstanding such official encouragement educational progress was at first extremely slow; there were still important and influential sections of the people bitterly opposed to the spread of Western system of education at the expense of the indigenous system based on a proficiency in the Sanskrit, the Arabic, the Persian and other Indian languages then widely cultivated and in the kind of knowledge imparted through these languages.

The official policy, however, reacted favourably with Raja Rammohan Roy, the greatest educationist, thinker and social reformer of the century and perhaps the greatest champion of Western education in India for all time. A century ahead of his time and fully imbued with the modern spirit of progress, dynamism and an unbound faith in the future of the nation, he was convinced with the superior merits and claims of Western education and clearly foresaw the possibility of improving the Hindu society through this education. He formed an association for founding an institution where the Hindus would receive instruction in the European languages and sciences, and thus initiated a movement in liberal education which culminated in the establishment of the Hindu College or the Mahavidyalaya on January 20, 1817. In this great endeavour he received the whole hearted support of such educationists and philanthropists as David Hare, Sir Edward Hyde East, Chief Justice of the Supreme Court and many prominent Hindu gentlemen of the time. The Hindu College produced a whole generation of leading men who were the harbingers of the nineteenth century literary, educational and cultural renaissance of Bengal. The Presidency College which was formally established in 1855 developed more or less from the Hindu College.

Educational Work of the Christian Missionaries

During this early period the Christian Missionaries rendered conspicuous service to the cause of the spread of liberal education in the country on the model of the European educational system. The activities of foreign religious missions may be traced as far back as 1706 in which year Danish Missionaries arrived in Tranquebar. Throughout the eighteenth century foreign missions arrived in India in regular succession and started their educational activities in the various coastal towns. In Bengal, the Mission of Carey, Marshman and Ward started their work at the Danish settlement of Serampore in 1793. After the first phase of their missionary work, they embarked on an educational programme about 1816 and started a number of schools in and around Serampore. Two years later in 1818 Serampore College was founded by Carey, Marshman and Ward, under the patronage of the Marquis of Hastings and Col. Krefting, the Danish Governor of Serampore, with the object of imparting education to Indian youth, both Christian and non-Christian, in literature and sciences and of course in theology. In 1821, the College received donation and in 1827 a Royal Charter from the King of Denmark. The Serampore Missionaries have gone down in the history of Bengal not only for their notable educational work, but also for their equally pioneering work in the study of modern Indian languages and for the establishment of the vernacular press. First Bengali newpaper, it may be noted in passing, is also due to the efforts of this Mission.

The Baptists Mission working at Dinajpore and Jessore and the London Missionary Society at Chinsurah also did useful work. Special mention may be made of the work of Rev. Alexander Duff of the General Assembly of the Church of Scotland, who established in 1830 the General Assembly's Institution. This institution after various changes and splits became the Scottish Churches College in 1908 and finally the Scottish Church College in 1929 on the reunion of the two main branches of the Scottish Church.

The principal aim of these missions was the spread of Christianity among the people of India through the English educational system ; but it was soon found that the young Indian pupils were attracted to these institutions more from a desire to acquire modern knowledge than by the lessons in Christianity. With the lapse of time the programme of secular education of these institutions became all important and the importance of religious instruction as part of their missionary activity gradually fell to the background. The aims of the missionary institutions were clearly expressed by Dr. Duff as follows:—"One great object was to convey, as largely as possible, a knowledge of our ordinary improved literature and science to the young persons ; but another, and more vital object was . . . to convey a thorough knowledge of Christianity with its evidences and doctrines. Our purpose was therefore to combine in close, inseparable and harmonious union what has been called a useful secular with a decidedly religious education".

Macaulay and English Education

We have referred to the controversy between the exponents of the Oriental learning based on the Arabic and the Sanskrit and those who wanted to see English system of education introduced and encouraged in the country. During the 'thirties of the last century the controversy gathered such momentum that the Committee of Public Instruction thought fit to refer the matter to the Government in 1835. On the advice of the Government, Macaulay who had come to Calcutta as the first Law Member of the Governor-General's Council submitted his famous Minute which fixed the educational policy of the Government for many decades to come. This historic document has been much discussed and criticized and his many exaggerated and unsympathetic remarks about the character of the people and the indigenous institutions profoundly wounded national feelings. If this Minute was responsible for depriving the country of a national education for generations, it also helped to open the flood gates of Western sciences, literature, law and social and political institutions. Macaulay himself foresaw all this. Long before he came out to India he made the following prophetic observation in the House of Commons, to which the University Education Commission of 1948 have also referred:

> "Are we to keep the people of India ignorant in order that we may keep them submissive? Or do we think that we can give knowledge without awakening ambition? Or do we mean to awaken ambition and to provide it with no legitimate vent? . . . It may be that the public mind of India may expand under our system until it has outgrown that system. . . . that having become instructed in European knowledge, they may, in some future age, demand European institutions. Whether such a day will ever come I know not. Whenever it comes it will be the proudest day in English History."

Macaulay's Minute was accepted by the Government of William Bentick. On March 7, 1835, the Governor-General in Council passed a resolution directing that 'the great object of the British Government ought to be the promotion of European literature and science' among the people of India and directing that 'all the funds at the disposal of the Government would henceforth be spent in imparting to the Indians a knowledge of English literature and science'.

Colleges before the Establishment of the Calcutta University

The Calcutta University was established in 1857 along with the two other Universities of Bombay and Madras. The half a century preceding the establishment of India's first university witnessed the founding and growth of a number of excellent colleges for instructions in higher education, of which we have only referred to the Hindu College, the forerunner of the Presidency College, the Serampore College and the General Assembly's Institution. Others established in this period include the Calcutta Madrassah, the Fort William College, the Sanskrit College, the Hughli Mohsin College, the Krishnagar College, the Bethune College, and the Krishnath College.

Calcutta Madrassah : The Calcutta Madrassah founded by Warren Hastings in 1790 is the first college to be established by the Government with the object of imparting instruction in Arabic and Persian. Persian, it may be recalled, was still the Court language in India. The Madrassah is still continuing its old traditions and affords Muslim students from all over India facilities for instruction in advanced Islamic courses.

Fort William College: The Fort William College was established in 1800 for the study and training of British civilians in the language and literature of the country. Since then it became incumbent on the civilians to pass an examination in the laws and regulations. Rev. William Carey joined the College in 1801 as teacher of the Bengali and Sanskrit languages. The College was responsible for the publication of a number of text books in Bengali, composed by the Pandits of the Bengali Department, which were the first of their kind. Carey himself composed a grammar and dictionary of the Bengali language.

Sanskrit College: The Sanskrit College was founded in 1824 for the encouragement of the study of the Sanskrit language and literature and also the cultivation of European literature and science. With this College were connected scholars like Iswar Chandra Vidyasagar, Mahesh Chandra Nyayaratna and Haraprasad Shastri. The Oriental Department for preparing pupils of the first, second and title examinations of the Bengal Sanskrit Association and special classes for teaching the Vedas were opened. The College section was affiliated to the B.A. standard.

Hughli Mohsin College: The College, situated at Chinsurah, 35 miles from Calcutta, was founded in 1836 and financed by the income from the funds bequeathed by Muhammad Mohsin, a wealthy Mahomedan gentleman who died without heirs in 1812. His large property yielding an annual income of Rs. 45,000 was at first left to the control of Mahomedan Trustees but later on passed under the management of the Government on the ground of misappropriation of the funds by the original trustees. During the period of litigation the income from the funds accumulated to form a surplus of Rs. 8,61,100 with which the College was founded. Entirely under the Government control and management, the College is now affiliated upto the standards of I.A., I.Sc., B.A., and B.Sc.

Krishnagar College: The College was founded by the Government in 1845 under the control of the Director of Public Instruction, Bengal. It imparted instructions upto the graduate standard till 1871 when the B.A. classes were temporarily suspended for financial difficulties. From about 1875 sufficient funds were raised from the generous public and the degree classes were restored in 1888.

Bethune College: The College was founded by the Hon'ble Mr. J. E. Drinkwater Bethune, Member of the Governor's Executive Council, in May, 1849. It was intended for education of Indian girls and was first held in the residence of Raja Dakshinaranjan Mukherjee. Raja Dakshinaranjan made a gift of a plot of land in Cornwallis Square, where the College's building was built in 1851. After the death of Bethune (August 12, 1851) the institution with the new building was handed over to the Government. In 1878, the College was amalgamated with the Banga Mahila Vidyalaya. In 1883, B.A. classes were opened in the College section, the College being affiliated with the University in 1888.

Krishnath College: The College established in 1853 had probably a much earlier origin. The older Gazetteers are unanimous in recording that a ' British college was opened in Berhampur as far back as 1826, which probably developed into the present college. The foundation stone of the building was laid in 1853, and it came into use in 1859 when the institution became a first grade college in Arts. A Law Department was added in 1864. The Maharaja of Cossimbazar donated a sum of Rs. 50,000 with which were instituted a number of scholarships. In 1886 the Government decided to transfer the college to private hands and Maharani Swarnamayi of Cossimbazar accepted to maintain the college initially for 5 years. Even after the death of the Maharani, the House of Cossimbazar have continued to accord financial help towards the maintenance of the institution.

Presidency College: We have said that the Presidency College developed out of the Hindu College. In 1885, the Hindu College was taken over by the Government and its name changed into 'Presidency College', under orders from the Court of Directors of the East India Company. From 1855 to 1910 the College was administered by the Education Department under the D.P.I., Bengal, after which period its administration was vested in a governing body constituted in accordance with the University Regulations. The College has been offering instructions upto the graduate and the post-graduate standards and has maintained research departments and laboratories of which a separate account has been given elsewhere in this Volume.

Medical and Engineering Education: The same period under review also witnessed the development of medical and engineering education in Calcutta and the foundation of institutions for imparting instructions and practical knowledge in these professional subjects. In 1833, a committee was appointed to report on the study of medical education then imparted in several institutions in Calcutta. The medical education in these institutions was largely based on the indigenous system of medicine, and the committee was also asked to enquire 'whether it would be expedient to confine the medical instruction to English lecturers and to adopt for class books small English treatises, discarding Sanskrit medical books altogether'. The committee recommended the establishment of a new institution in which 'the various branches of medical sciences cultivated in Europe should be taught and as near as possible on the most approved European system'. Following this recommendation, the Medical College was founded in 1835 and the medical sections attached to the Sanskrit College, the Madrassah and other places were abolished. The Medical College of Bengal can claim to be the first medical institution which combined instruction in preliminary sciences with clinical training in all the medical subjects as medicine, surgery and midwifery, and provided all-round instructions to candidates joining it. The College was affiliated to the University in 1857.

The first move towards introducing engineering education on Western lines in Bengal was taken when a Chair of Engineering was sanctioned for the Hindu College in 1844, which, however, remained vacant for want of a suitable professor. In 1848, the Earl of Dalhousie suggested the establishment of an engineering college in each of the three Presidencies of Bengal, Bombay and Madras. But no such institution could be established before 1856 in which year an institution was opened in the Writers' Buildings. The Bengal Engineering College, the later stage of this institution, was opened at its present site on April 5, 1880.

Foundation of the Calcutta University

Thus higher education progressed at rapid strides in Bengal during the first half of the nineteenth century. Men educated at the newly established institutions under the new system of education gave a good account of themselves and many of them assumed positions of leadership in the social and cultural fields, if not yet in the political field. But the structure of higher education could not be completed without the establishment of universities. About the middle of the century it became apparent that time had come for the establishment of universities and for giving fresh lead and direction to higher education and learning. Such considerations prompted the famous despatch of Sir Charles Wood to the Court of Directors of 1854, which has been aptly described as the 'Magna Charta of English Education in India'. The Despatch not only set forth a plan of education far wider and more comprehensive than any suggested hithertofore, but, what was more important, directed the organization of universities at Calcutta, Bombay and Madras for encouraging a regular and liberal course of education by conferring degrees upon those who had gone through prescribed courses of study at the affiliated institutions and passed required examinations. Three years after, bills for the establishment of the three universities were drafted, and the University of Calcutta was founded, along with the Universities of Bombay and Madras, by an Act of Incorporation (Act No. II of 1857), on January 24, 1857.

The Calcutta University adopted the form, government and regulations of the London University and started with four Faculties, *viz.*, Arts, Law, Medicine. and Engineering. The Governor-General was the Chancellor of the University which had a Vice-Chancellor nominated by the Chancellor and a Senate of 38 members of whom 6 were Indians. The executive government of the University was vested in a Syndicate of 11 persons including the Vice-Chancellor. The University was authorized to confer degrees of the Bachelor of Arts, Master of Arts, Bachelor of Law, Licentiate of Medicine, Doctor of Medicine and Master of Civil Engineering. A supplementary Act was passed in 1860 (Act No. XLVII of 1860) giving the power to confer degrees other than those previously provided. As a result of this Act, the First Examination in Arts, the License in Law

Examination and the License in Civil Engineering Examination were instituted in 1861. The first University Entrance Examination was held in 1857, in which 162 candidates came out successful out of 244. Thirteen candidates appeared at the first degree examination, held in 1858, of whom 2 were successful, including the celebrated novelist Bankim Chandra Chatterjee.

In 1875, the University was empowered, by another Act, to confer honorary Degree of Doctor in the Faculty of Law upon any person of eminence and attainments without requiring him to undergo any examination. This Act amended in 1884 provided for the award of similar honorary degrees in other Faculties.

With such provisions for academic degrees and examinations, the University provided a new fillip to higher education which became manifest in the growth of high schools and colleges and rise in the student population. In Bengal, Bihar and Orissa over which the jurisdiction of the University then extended the number of high schools rose from 133 in 1871 to 209 in 1883. Many new first grade colleges came into existence. In the absence of limited opportunities in the fields of industry, commerce and other vocation, the University degrees came to be looked upon, not without justification, as passports to lucrative government and private employment, and the educational institutions attracted larger and larger number of students with the passage of years. During the first fifty years of its existence the University remained only an examining body granting diplomas and degrees to the successful candidates. It had not yet assumed the more important function of developing higher teaching and learning under its direct supervision through the institution of University professors, readers and other academic posts and of teaching and research departments.

Development of Colleges after 1857

After the establishment of the Calcutta University, many colleges came into existence—a few through the efforts of the foreign Christian missions, but mostly through private efforts under the leadership of distinguished Indian educationists. We shall briefly refer to the history of establishment of some of these colleges in what follows.

Vidyasagar College: The institution was originally founded in 1859 under the name of Calcutta Training School by a body of prominent Hindu gentlemen. In 1864, the management devolved entirely on Pandit Iswar Chandra Vidyasagar, and its name was changed to Metropolitan Institution. Between the years 1872 and 1879, the Institution was affiliated to the University first to the F.A. and then to the graduate standard. Subsequently the law and science classes were introduced. The Institution was largely the handiwork of Iswar Chandra Vidyasagar and represented the first attempt to impart collegiate education to middle class Hindus at a small cost. In 1917, the name of the college was changed to Vidyasagar College as a fitting memory to the great educationist who was the principal architect of the institution.

St. Xavier's College: The Society of Jesus established the St. Xavier's College in 1860 at 10, Park Street in the building which had been St. John's College in the time of Dr. Carew. The object of this institution is to give Catholic youths a full course of liberal education, but the students of other religious communities are freely admitted. The College has played an important role in the spread of scientific education in the city. Rev. Fr. Lafont, S.J., a great pioneer of scientific education in those days, not only made a fine collection of scientific apparatus for the college, but also helped in the development of scientific education and research in other institutions. He was very intimately associated with Dr. Mahendralal Sircir's Science Association and significantly contributed to its development during the early stages. The College has an astronomical observatory equipped with 9″ refracting equatorial and 10″ reflector and was long noted for its meteorological work.

St. Paul's Cathedral Mission College: The College was originally founded in 1865 as the Cathedral Mission College at Mirzapore Street. It was refounded in 1899 under the name of Church Missionary Society's College and moved to its present premises at Amherst Street in 1908. It was raised to the B.A. standard and the present name was adopted in 1914.

City College: The College developed from the School bearing the same name and founded in 1879. The F.A. classes were opened in 1881 and the B.A. in 1884. Managed by the Brahmo Samaj Education Society, the College has the object of promoting 'the cause of education in the highest and widest sense, to make the education comprehending the mind, heart and body, and founded on a theistic basis, conducive to the good of man and the glory of God'. The institution is open to all without distinction of race, creed or cast.

Surendranath College: Like the Vidyasagar College, this institution is also the handiwork of another great son of Bengal and father of Indian nationalism, Surendranath Banerjee. It was originally established as a school under the name of the Presidency School in 1880. In 1882, the management of the school passed into the hands of Surendranath Banerjee and the school soon developed into a first grade college (1884). The college was known under the name of Ripon College. After the Independence, its name has been changed to Surendranath College.

Bangabasi College: The College grew out of the Bangabasi School founded in 1885 by late Mr. G. C. Bose. Following the success of the School, the College department affiliated to the F.A. standard was started in 1887. Graduate classes in law and arts and M.A. classes were started later on. After the organization of the post-graduate departments of the University, the M.A. classes were discontinued.

David Hare Training College: The College was opened on July 1, 1908 by the Government of Bengal to train teachers for secondary schools as well as inspecting officers. It prepares students for the B.T. degree and has up-to-date facilities for the training of teachers.

Asutosh College: The College was first started with the name of South Suburban College by the authorities of the South Suburban School in 1874 and was affiliated to the University in 1915. In July, 1924, after the death of Sir Asutosh Mookerjee, its Founder President, the College was renamed Asutosh College in honour of the first President. A Women's Department was later (1932) attached to it. It has removed the long felt need for a college in South Calcutta.

Central Calcutta College: As early as 1881 the Government of Bengal thought of establishing a second grade college for higher education of the Mahomedan community. In 1884, Intermediate classes were started in the Calcutta Madrassah but in 1888 these classes were amalgamated with those of the Presidency College. Renewed efforts made from 1923 on to establish a separate college exclusively for the Mahomedan students finally led to the founding of the Islamia College in 1926 with affilition for the intermediate and the degree classes. The name of the College was changed to the Central Calcutta College after the partition of the province, and it is now open to members of all communities.

Women's Education: Calcutta has also made great progress in the field of women's education. Bethune College pioneered in this direction and in course of time many other institutions offered facilities for higher education to women. The following institutions impart instruction to the women students only:

Bethune College
Loreto House
Victoria Institution
Gokhale Memorial Girls' College
South Calcutta Girls' College
Lady Brabourne College
Women's College
Ballygunge Muralidhar Girls' College
Women's Christian College
Girls' College, Howrah

The following institutions originally meant only for men have made special arrangement for separate or co-education of women students: City College, Asutosh College, Surendranath College, Scottish Church College and Presidency College. There is co-education for post-graduate studies in the University Colleges and also for medical studies.

Universities Commission of 1902—Universities Act of 1904

The Universities Commission of 1902 and Universities Act of 1904 laid emphasis precisely on the importance of the teaching functions of the University, and empowered the University to institute professorships, readerships and lecturerships, to maintain lecture rooms, libraries, museums, laboratories and workshops for the promotion of teaching and research, to grant doctorate degrees on thesis, to exercise greater control on the affiliated colleges, and to impose more exacting conditions on affiliation. The examination system was also greatly modified in certain respects. The Entrance Examination was replaced by the Matriculation Examination; I.A. and I.Sc. took the place of F.A.; B.A. and M.A. degrees were split up each into two degrees, one for Arts (B.A., M.A.) and the other for Science (B.Sc., M.Sc.).

Diplomas and degrees in teaching were introduced, as also degree in commerce and diploma in public health. The composition of the Senate was altered as having a total strength not less than 50 and not exceeding 100. The number of elected Fellows was fixed at 20, and statutary recognition was given to the Syndicate with adequate representation of university teachers on it. The Calcutta University has been governed mainly by the constitution framed under this Act till the passage of the Calcutta University Bill of 1951.

Establishment of the University Post-graduate Departments

In 1917, the provisions of the 1904 Act relating to the creation of teaching departments under the management and supervision of the University were given effect to. Under the dominating leadership of Sir Asutosh Mookerjee, the University established the Post-Graduate Departments, appointed a number of professors and lecturers and ushered in a new chapter in its chequered history. The fine work of the galaxy of brilliant scholars who held these professorships immediately brought fame and recognition to the University which became the unrivalled centre of higher learning and research in the East. As far back as 1862, the Hon'ble Prasunna Coomar Tagore bequeathed to the University, by a will, a monthly allowance of Rs. 1,000 for the purpose of founding a Professorship in Law, first held by Herbert Cowell (1870-72), a renowned scholar in Hindu Law. Many able lawyers and jurists have since held this post. In 1908, the Minto Professorship of Economics was established to commemorate the Jubilee of the University on the expressed willingness of the Government of India to maintain this professorship. Prof. Manoharlal (1909-12) was the first occupant of the chair. The Hardinge Professorship of Higher Mathematics was established in 1912, with W. H. Young (1913-1916) as the first professor, out of the recurring grant of Rs. 65,000 from the Government. The same year the University instituted the chair of Carmichael Professorship of Ancient Indian History and Culture and invited G. Thibaut (1913-14), the celebrated oriental scholar, to the post. Although the institution of some of these professorships was made possible by the financial grants received from the Government, such grants did not flow generously enough to create many more chairs in the varied subjects of teaching and research.

Sir Asutosh appealed to the generous and public spirited men of his time and magnificent response was received from such persons as Sir Taraknath Palit, Sir Rashbehary Ghose and Rani Bageswari and Kumar Guruprasad Singh of Khaira, whose munificent donations enabled the University to create a whole series of chairs and a number of research scholarships. In 1912, Sir T. N. Palit came forward with a princely gift worth about Rs. 15,00,000 for the foundation of two chairs, one in Chemistry and the other in Physics, and for establishing a number of research scholarships, and made over to the University part of his extensive property in Calcutta. Sir P. C. Ray and Sir C. V. Raman were appointed the first Palit Professors in Chemistry and Physics respectively. In

1913, Sir Rashbehary Ghose offered to place at the disposal of the University the munificent sum of Rs. 10,00,000 for the promotion of scientific and technical education and for the cultivation and advancement of science, pure and applied. In January 1914, the University decided to establish four Sir Rashbehary Ghose Professorships in Applied Mathematics, Chemistry, Physics and Botany and appointed Dr. Ganesh Prasad, Dr. P. C. Mitter, Dr. D. M. Bose, and Dr. S. P. Agharkar to these professorships. Five years later in December, 1919, Sir Rashbehary again came forward with another gift of Rs. 11,43,000 for purposes of technical instruction and research, with which two more University Chairs known after his name were created, one in Applied Chemistry and the other in Applied Physics. Dr. H. K. Sen and Dr. P. N. Ghose were the first occupants of these chairs. The creation of the five University Chairs in Indian Fine Arts, Phonetics, Physics, Chemistry, and Agriculture was made possible by the decree of the High Court in the suit of Rani Bageswari Devi against Kumar Guruprasad Singh of Khaira, which provided that the ultimate use of the fund (Rs. 5,50,000) vested in the University was to be carried out 'under the direction of and according to a scheme to be framed by Sir Asutosh Mookerjee'. The first five professors to these newly created chairs were Dr. Abanidranath Tagore, Dr. Suniti Kumar Chatterji, Dr. Meghnad Saha, Dr. J. N. Mukherjee and Dr. N. N. Ganguli. If Sir Asutosh succeeded in organizing his cherished post-graduate departments, it was due entirely to such princely private gifts of philanthropic men like Sir T. N. Palit and Sir Rashbehary Ghose who thus set up an unparalleled example in this sub-continent for all time to come.

Calcutta University Commission of 1917

While Sir Asutosh Mookerjee was engaged in the work of organizing the post-graduate departments, the Government of India appointed the Calcutta University Commission, under the chairmanship of Sir Michael Sadler, for holding an enquiry of a very comprehensive nature and searching character into the problems of the Calcutta University. The Commission recommended a number of far-reaching and fundamental changes, such as the creation of a Board of Secondary Education, establishment of the intermediate colleges, introduction of a three-year degree course, closer integration of the degree collges with the University so that all the institutions became part and parcel of the University, and the encouragement of university centres at suitable mofussil areas. The Commission were inclined to see the University develop as a federal university gradually giving up its present affiliating character with little or no control over the collegiate education. Although other universities of India adopted many of the Commission's recommendations, the Calcutta University did not adopt them on various grounds into which we need not enter here.

Present set-up of the University

The present University authorities are: (1) the Chancellor (Governor of West Bengal for the time being), (2) the Vice-Chancellor, (3) the *Ex-officio* Fellows, and (4) the Ordinary Fellows.

The *Senate* is composed of the Chancellor, the Vice-Chancellor, and Fellows and is the governing body of the University having powers to make and alter by-laws and regulations subject to the approval of the Government of West Bengal. The Senate is divided into five Faculties, *e.g.*, Arts, Science, Law, Medicine, and Engineering. Very recently the Faculty of Technology has been added.

In the *Syndicate* is vested the executive government of the University. It consists of Vice-Chancellor as chairman, the D.P.I. of West Bengal, and fifteen Fellows who are elected for a period of one year, partly by the Senate and partly by the Faculties as follows:—4 by the Senate; 4 by the Faculty of Arts; 2 by the Faculty of Science; 2 by the Faculty of Law; 2 by the Faculty of Medicine; and 1 by the Faculty of Engineering.

Two *Councils of Post-Graduate Teaching*, one for Arts and the other for Science, are responsible for the conduct of post-graduate teaching.

The following shows the number of successful candidates at the different examinations during the year 1949 (Inter-University Board of India: Handbook of the Universities: 1951):—

Matriculation (with supplementary)	19,058
I.A. (with compartmental and supplementary)	4,789
I.Sc. Do.	4,578
B.A. Do.	1,575
B.Sc. Do.	1,152
M.A.	602
M.Sc.	166
B.Com. (with compartmental and supplementary)	1,473
B.T. Do.	194
Teachership (Arts appreciation)	4
Diploma in Domestic Science	13
Diploma in Social Work	54
Certificate in Social Work	13
Diploma in Spoken English	1
Junior Military Certificate	114
Diploma in Soap Technology	4
Diploma in Librarianship	16
Certificate in Tanning	3
Preliminary Law	286
Intermediate Law	193
Final Law	179
B.E. (Part I) (with supplementary)	120
B.E. (Part II) Do.	112
Bachelor of Metallurgy	2
M.E. (Public Health)	11
First M.B. (new)	289

Final M.B. (Part I—B)	571
Do (Part I)	101
Final M.B.	464
D.P.H. (Part I)	49
D.P.H. (Part II)	47
Diploma in Maternity and Child Welfare	2
Diploma in Obstetrics and Gynaecology	4
Diploma in Ophthalmic Medicine and Surgery	4
Certificate in Applied Psychology	2

The University has an excellent central library with about 2,03,400 volumes and a number of departmental libraries, a Museum of Indian Art known after the name of late Sir Asutosh Mookerjee, an Appointments and Information Board. An account of the aforesaid library and the museum will be found elsewhere in this volume. A large number of scholarships, medals and prizes are awarded every year for proficiency in various examinations. A large number of Research Fellowships and scholarships have also been established and there are some provisions, although inadequate, for overseas scholarships and travel grants.

University Education Commission of 1948

The attainment of Independence and the adoption of the new Constitution for free India made it imperative to go into the whole question of university education and 'suggest improvements and extensions that may be desirable to suit present and future requirements of the country'. On November 4, 1948, the Government of India appointed the University Education Commission under the chairmanship of Dr. S. Radhakrishnan. The Commission had very wide terms of reference and were asked to study and report on almost every aspect of university education. A voluminous report comprising 747 pages was submitted in August 1949. Many of their criticisms and recommendations bear directly on the Calcutta University. For example, the Commission were unsparing in their criticism of the growth of some of the mammoth Calcutta colleges, which has resulted in a fall in efficiency and overall standard of teaching and in the poor quality of the university graduates. The university constitution has been discussed at length and their recommendations in favour of the unitary and the federative types of university closely remind one of similar recommendations of the Sadler Commission. We quote below some of their recommendations:—

> "That the standard of admission to the university course should correspond to that of the present intermediate examination, *i.e.*, after the completion of 12 years of study at a school and an intermediate college;
>
> That in each province a large number of well-equipped and well staffed intermediate colleges . . be established;
>
> That in order to divert students to different vocations after 10 to 12 years of schooling, a large number of occupational institutes be opened;
>
> That to avoid overcrowding at universities and colleges, the maximum number in the Arts and Science faculties of a teaching university be fixed at 3,000 and in an affiliated college at 1,500;

That the university education be placed on the concurrent list;

That the concern of the Central Government with the universities be with regard to finance, coordination of facilities in special subjects, adoption of national policies, ensuring minimum standards of efficient administration and liaison between universities and national research laboratories and scientific surveys etc.;

That for allocating grants to universities a Central Grants Commission be established, . . . ;

That there be no university of the purely affiliating type;

That government colleges be gradually transformed into constituent colleges of the univereity;

That college governing bodies be properly constituted (and the number of colleges affiliated to a university be limited);

That the aim of an affiliated college be to develop into a unitary university and later into a federative one.

The Commission have strongly disapproved of the practice of having honorary Vice-Chancellor and have recommended the appointment of whole-time paid Vice-Chancellor as the executive head of the university organization.

Calcutta University Act of 1951

The Calcutta University Act of 1951 is largely based on the recommendations of the University Commission. The Act has provided for a paid Vice-Chancellor, a Treasurer and other officers, has considerably democratized the composition of the Senate and has replaced the two post-graduate councils of teaching by an Academic Council of reasonable size.

Visva-Bharati

VISVA-BHARATI grew out of the Santiniketan Asrama, founded by the Poet's father, Maharshi Devendranath in 1863. The Asrama was meant to be a retreat where seekers after Truth might come and meditate in peace and seclusion. In 1901, an experimental school was started at Santiniketan by Rabindranath with the object of providing for a limited number of children as complete an education as possible—an education which will be in constant touch with Nature and Life, so that the pupils may learn and grow in an atmosphere of freedom, mutual trust and joy. Since 1921, Santiniketan is known as the seat of Visva-Bharati, an international university seeking to develop a basis on which the cultures of the East and the West may meet in common fellowship.

Visva-Bharati has recently been incorporated as a university by an Act of the Indian Parliament and was formally inaugurated by Maulana Abul Kalam Azad on September 22, 1951.

An idea of the many-sided activities of Visva-Bharati can be had from the programme of work of the following constituent institutions:

Patha-Bhavana, which is mainly residential, is a progressive school imparting elementary and secondary education to children. Close personal contact with the teacher, the influence of Nature and environment, the atmosphere of freedom and joy, the practical training given in co-operation and self-government, the effort made to develop the self-expressive side of the child-mind through social, literary, artistic, musical and craft activities are some of the special features of the school.

Siksha-Bhavana provides collegiate education in arts subjects, both pass and honours, up to the graduation level, and in sciences for intermediate students.

Kala-Bhavana (School of Fine Arts and Crafts) has developed into a well-known centre of Indian Art. Training is provided in studies in drawing, painting, modelling, sculpture, etching, wood and lino-cut, fresco-painting, *alpana* and design-drawing, embroidery, batique and artistic leather-work. The department maintains a museum, a library and an exhibition hall.

Sangita-Bhavana imparts training in vocal and instrumental music, especially in songs composed by Tagore, as well as in dancing. A systematic study is made here of different modes and styles of music and dancing extant in the different parts of India, with a view to correlating them into a rich synthesis.

Vidya-Bhavana, the post-graduate research section, is mainly concerned with indological studies—studies in Vedic, Puranic, Buddhist, Jain, Zoroastrian and Islamic cultures. Another line of study which has been latterly added to its programme is that of the major languages and literatures of India. It has already started M.A. classes in Bengali and Ancient Indian History and Culture.

Hindi Bhavana, besides doing original research work in Hindi literature, has undertaken supervision of Hindi translation of Tagore's works.

Cheena-Bhavana, established in 1937, seeks to revive the old cultural links between the two ancient countries. Sinology and Tibetan studies form the main interest of this section. It maintains an excellent library, a lecture hall and exhibition gallery.

Dinabandhu-Bhavana, the Western and Christian Studies Section, has been named after Dinabandhu C.F. Andrews. This section is concerned mainly with studies designed to further contact and understanding between the East and the West in their cultural and humanistic aspects.

Rabindra-Bhavana is organized both as a memorial museum and as an academy of research for studying the life and work of the Poet.

Vinaya-Bhavana (Teachers' Training Institute), which started functioning in September 1948, has recently been converted into a B.T. training institution just with the inauguration of Visva-Bharati as a Central University.

An Institute of Rural Reconstruction was started at Sriniketan in 1922 with the active help of Leonard K. Elmhirst as the first director. The ideal of the Institute in the words of the Poet is "to bring back life in its completeness into the villages, making the rural folk self-reliant and self-respectful, acquainted with their own cultural traditions and competent to make an efficient use of modern resources for the improvement of their physical, intellectual and economic condition" Starting with only three neighbouring villages, Sriniketan has now extended its activities to a much larger area. The different departments at Sriniketan are: (*a*) Department of Agriculture, Animal Husbandry and Pisciculture; (*b*) Department of Education; (*c*) Department of Rural Health and Sanitation; (*d*) Department of Economic Research; (*e*) Village Welfare Department; and (*f*) Silpa-Bhavana (Institute of Rural Industries).

Visva-Bharati has its own Press at Santiniketan and a Publication Department. Its publications include (*i*) writings of Tagore, edited with annotations; (*ii*) books for folk education; (*iii*) books of general knowledge; (*iv*) research publications; and (*v*) juvenile's books. *Visva-Bharati* News, the monthly news bulletin, and, *Visva-Bharati Quarterly*, the cultural journal have a large number of readers in India and abroad. *Visva-Bharati Patrika*, published in Bengali, is also a well-known journal.

There is, besides, a Central General Library at Santiniketan.

National Council of Education

THE National Council of Education, Bengal, was formed during the great national movement which commenced in 1905 with partition of Bengal. The Council may be said to represent one of the earliest expressions of the consciously creative force in Indian nationalism. It was in revolt against the political thraldom and educational policy of the British Indian Government that this independent organization was set up in a dependent country in which education was too stereotyped and tended to develop in our youngmen a kind of servile mentality and an inferiority complex. The institution was intended by its founders to be a university to impart education, literary and scientific as well as technical and professional, on national lines and exclusively under national control, not in opposition to, but standing apart from the existing system of primary, secondary and collegiate education, attaching special importance to a knowledge of the country, its literature, history and philosophy, and designed to incorporate with the best Oriental ideals of life and thought the best assimilable ideals of the West, and inspire students with a genuine love for and desire to serve the country. The Council aimed at imparting education in an atmosphere in which students would work with perfect freedom under the guidance of selfless and devoted teachers and be equipped with such training as will develop an intense love and desire for service of the motherland.

The foundation of the National Council of Education was rendered possible by the munificence of three generous donors, the late Raja Subodh Chandra Mallik, Sj. Brajendra Kishore Roy Choudhury of Gouripur and the late Maharaja Suryya Kanta Acharyya Choudhury Bahadur of Mymensingh. The first President of the Council was Sir Rashbehary Ghosh, the then leading lawyer of the Calcutta High Court. With the early days of the N. C. E. were associated nearly all the notable figures of the time, some of whom later won world recognition, men like Poet Rabindranath Tagore, Sri Aurobindo and others. A number of highly qualified men, imbued with desire to serve the nation, joined the institution as teachers on very low salary. This self-sacrificing band, which included Sri Aurobindo Ghose, Benoy Kumar Sarkar and many others created an ideal and a tradition for the institution.

Simultaneously with the foundation of the N.C.E., another institution was started purely for technical education, financed mainly by the late Sir Tarak Nath Palit. In 1910, this institution was amalgamated with the N.C.E. The National Council at first maintained both arts and science and technical departments, but finding that public demand for technical education was more insistent, the Council has been devoting for the last 45 years almost the whole of its resources to technical education through its College of Engineering and Technology.

For this reason as well as due to its limited financial resources, the Council has not been able to extend its activities in the cause of general education. At present its activities in this field are restricted to its granting affiliation and grant-in-aid to a few primary and high schools and to its maintaining two Chairs in Indian History and Philosophy. For the schools, the Council holds the Final School Standard Examination which is recognized as equivalent to the Matriculation Examination by the University of Calcutta and the Government of West Bengal. The Chairs are held by eminent scholars. Some valuable research work has been done by the successive incumbents of these Chairs and the Council has a number of publications.

In 1921, the Council had the good fortune to secure a donation of about 13 lakhs of rupees under the will of the late Sir Rashbehary Ghosh. This princely bequest enabled the Council to erect extensive buildings and workshops on its present site at Jadavpur. The present site of the College of Engineering and Technology is a gift of the Corporation of Calcutta, which leased out to the Council 192 bighas of land on a nominal rent. In addition to this land, the Corporation has been making an annual grant since 1927. The Government of Bengal have also made a non-recurring grant of Rs. 3 lakhs and a recurring grant of Rs. 40,000 from the year 1947 for the development of the Chemical Engineering Department. The Central Government have also agreed to make available to the College the following grants:

Capital:	Buildings	...	...	... Rs.	3,83,000
	Equipment	...	...	... Rs.	21,77,000

Recurring: Actual excess of the permissible expenditure of a recurring nature incurred by the institution in giving effect to the scheme of development, over receipt from fees and other sources, is limited to Rs. 5,98,000 per annum.

The activities of the College are described under "Engineering and Technological Education and Research."

The College has trained over a thousand engineers so far and there is hardly any industrial organization of any repute in the country in which ex-students of this College are not serving in some capacity or other. Quite a number of the ex-students have been pioneers in setting up industries such as manufacture of electric bulbs, lamps, electric motors, electric fans, belts, etc.

With the transfer of power from British to Indian hands this institution came for the first time to receive recognition from the State and both the Government of India and the Government of West Bengal have made and are making grants to the institution for further development.

Apart from its plan to develop the College of Engineering and Technology to the standard of higher technical institutions abroad, the Council has plans to establish model schools and eventually to develop as a statutory university.

Research on Fundamental Sciences

Introduction

THE beginnings of researches in India according to newer occidental methods, probably date with the foundation of the Asiatic Society in Calcutta, on January 15, 1784 by Sir William Jones. This became the prototype of innumerable societies for oriental researches in different parts of the world. The civilizations of the leading countries of Asia had reached a state of stagnation at a time when the renaissance movement in Europe, with its discovery of a new scientific method, was producing revolutionary advances in science, technology, and navigation. It required the stimulus of the vigorous western techniques to rejuvenate the eastern cultures. Their responses varied according to the state of development and the natural aptitudes of the people. After the British had consolidated their position in Bengal, they made Calcutta the headquarters of their administration, and in course of time many able administrators, jurists, scientists and missionaries came over to India and found a country rich in unexplored natural resources, uncharted geophysically, with vast accumulation of tradition, culture and religious beliefs, providing extremely fruitful materials for investigation by the techniques they had learnt at home. One of the first fruits of their activities was the discovery of the treasures stored up in Sanskrit literature, some of which in translation attracted the attention of scholars of the West and led to the foundation of the new discipline of comparative philology.

The feelings of an imaginative western philosopher, first arriving into the field of his future activities, was well expressed by Sir William Jones in his address inaugurating the Asiatic Society, before a meeting of about 30 Europeans in Calcutta: "When I was at sea last August on my voyage to this country which I so ardently desired to visit, I found on one evening in inspecting the observations of the day, that *India* lay before us, and *Persia* to our left, whilst a breeze from *Arabia* blew nearly on our stern............It gave me inexpressible pleasure to find myself in the midst of so noble an amphitheatre almost encircled by vast regions of *Asia*, which has ever been esteemed the nurse of sciences, the inventress of delightful and useful arts, the scene of glorious actions, fertile in the production of human genius, abounding in natural wonders, and infinitely diversified in the forms of religion and government, in the laws, manners, customs and languages.............I could not help remarking how important and extensive a field was yet unexplored, and how many solid advantages unimproved". William Jones' memorable words on the scope of and geographical limits to the activities of the newly founded Society have been paraphrased in the Memorandum of the Society as: "The bounds of its investigation will be the geographical limits of Asia, and within its limits its enquiries will be extended to whatever is performed by man or produced by Nature". The bounds of investigations were not confined only to natural sciences but also included cultural sciences, all of which are included in the comprehensive German word 'Wissenschaften'; in this respect the new Society followed more the traditions of the continental academies rather than those of the Royal Society of London. In this introduction we shall review the leading landmarks in the development of this 'Wissenschaft' in Bengal which means chiefly Calcutta, from the times of William Jones to the present days.

On the Indian side, one of the first products of this impact from the West, was the rise of a universal man of genius in the personality of Rammohan Roy. His importance to us is based (*i*) on his recognition of the value, as he put forth in an open letter to Lord Amherst as early as 1823, of a more enlightened educational policy "embracing Mathematics, Natural Philosophy, Chemistry, Anatomy, with other useful Sciences.............., in providing a college furnished with necessary books, instruments and other apparatus". This was written about 12 years before Lord Macaulay published his famous Minutes which decided the Government to introduce courses in English literature and science in the educational curriculum. Rammohan Roy's deep admiration for Western philosophy and machinery of government of the Western democratic countries is well known, and it is a matter of deep regret that the experience he gathered during his sojourn abroad by coming into contact with the leading minds of Britain and France could not, due to his death in England, be made useful to his country. (*ii*) For our present review, his important contribution lay in his being a pioneer in the comparative study of religion, in his quest for discovering the universal element common to all great religions. For this purpose he studied the Hindu scriptures in Sanskrit, the Korans in Arabic, the old Testament in Hebrew and the New testament in Greek; besides he was a great scholar in Persian and knew Tibetan. His contribution to the comparative study of religion is contemporary to that of the founding of comparative philology in Europe.

Till very recently the contributions of the Asiatic Society to the advancement of knowledge, which were of a very considerable nature, were mainly the work of British scientists in Government services; they will be considered in a separate article. The virtual exclusion of the peoples of the country in participation in such work naturally aroused a strong desire for the organization of scientific research under Indian control, for the purpose of providing opportunities for scientific research to Indians. The plan for the founding of such a research institute was discussed by Dr. Mahendralal Sarkar as early as 1869, and given effect to in

1876 by the foundation of the Indian Association for the Cultivation of Science. Research work in this institution really commenced seriously after C. V. Raman joined the Association as part-time worker in 1907, while he was still an officer in the Finance Department. The contributions of Raman and Krishnan to the study of light scattering from this institute, which led to the discovery of Raman Effect is well known.

Even before Raman commenced his researches, J. C. Bose and P. C. Ray professors in the Presidency College, Calcutta, had made significant contributions to physics and chemistry, which aroused the conviction amongst their countrymen of the capacity of Indians to undertake original research. Many able young men were attracted by their examples to take up research.

Original investigations in the Calcutta University were made possible by the regulations enacted since 1909, empowering the University to centralize post-graduate teaching under the direct control of the University. During Sir Asutosh Mookerjee's tenure of office as Vice-Chancellor, steps were taken to found a large number of University and endowed chairs in arts and sciences. The building of the University College of Science for teaching and research in pure and applied sciences in 1916 marked a definite step forward in the encouragement of research amongst the younger generation of scientific workers. Some of the first products of the Science College included men like P. N. Ghosh, M. N. Saha, S. N. Bose, S. K. Mitra, S. K. Banerji, J. C. Ghosh, J. N. Mukherji, H. K. Sen, G. S. Bose, who are or were holding important positions in scientific and technological institutes. In this connection mention should be made of the services of P. C. Ray as the mentor and inspirer of the spirit of research in the younger generation of scientists of Bengal.

The next important step in this direction was the foundation in 1917 by J. C. Bose of the Bose Institute. Most of his fundamental investigations extending from 1894 to his retirement in 1915 were performed in the Presidency College, Calcutta, and the Bose Institute was started to enable him to continue his plant physiological investigations. J. C. Bose's researches can roughly be divided into three periods: (*i*) from 1894-1898 when he studied the properties of very short electro-magnetic waves, which led to his discovery of fatigue effect in detectors of e.m. radiation; (*ii*) 1900-1905 to the investigations on the similarity of responses in the living and the non-living matter; (*iii*) 1906-1937 to the study of plant responses. In every instance, his aim was to investigate some of border regions in science (*a*) between electric and light radiations, (*b*) between living and non-living substances, and (*c*) similarity of responses in plant and animals. His later investigations were coloured by the pantheistic outlook of his country, on the universality of life phenomenon. The other Indian scientists have confined their researches to conventional lines taken over from western countries. Herein lies the importance of J. C. Bose in the history of Indian thought.

In conclusion, we shall refer to the organization of departments in the Calcutta University for study in subjects like Sanskrit, Pali, Indian Vernaculars, Comparative Philology, Ancient Indian History and Culture during Sir Asutosh's regime. In this work of organization, the advice of Dr. Brojendra Nath Seal, the great encyclopaedist of Bengal, better known as inspirer of a group of brilliant scholars than by his own publications, was very valuable. It was felt that for a proper appreciation of the influence of Indian thought and culture on neighbouring countries, study of Chinese, Tibetan and of other Asian languages, some of them forgotten, was essential. In this way the pioneering work of the Asiatic Society in humanistic studies was extended. Inauguration of similar studies on an even wider basis was made possible by the foundation of the Visva Bharati in 1921 by Rabindranath Tagore. One of the aims of this institution is: 'To bring into more intimate relation with one another, through patient study and research, the different cultures of the East on the basis of their underlying unity. To approach the West from the standpoint of such a unity of life and thought of Asia'.

The programme of research outlined by Sir William Jones before the Asiatic Society has, in the course of a century and half, been taken up by other organizations and extended in many directions. The characteristics of the leading personalities, from William Jones to Rabindranath Tagore, who were associated with this great movement, are their comprehensive and imaginative approach, and their constant search for unifying principles. On the other hand, sufficient attention has not been given by the peoples of this province to the solution of concrete problems of existence associated with the development of agriculture, commerce and industries.

Asiatic Society

The circumstance leading to the foundation of the Society in 1784 has been briefly dealt with in the introduction. During Sir William Jones' lifetime, *i.e.*, till 1794, the meetings of the Society were held in the Grand Jury Room of the Supreme Court. After several years of visscitudes the Government were persuaded to make over to the Society in 1805 the plot of land at the junction of Chowringhee and Park Street. Building construction was commenced the same year and completed in 1808. The present building is therefore 143 years old and one of the oldest in Calcutta.

The Society derives a substantial income from the leasing of the plot of land to the west of its own building. This amount together with income derived from subscriptions, Government grants both Central and State, some of which are earmarked for special purposes, represent the several sources of income of the Society.

Recently it has been felt that more space is required for providing additional accommodation for housing the steady accumulation of books and manuscripts in the library, as well of its own publications. Schemes have been provisionally approved for the erection of a three storied building on the unbuilt area to the west, of which one floor will be reserved for the use of the Society, and the other two will be let out. Thus when the loan incurred for building construction has been repaid, another steady source of income will become available. The Society provides accommodation to the offices of the Indian Science Congress Association and the office of publication section of the National Institute of Sciences of India.

Administration and Membership: The affairs of the Society are managed by a council, with the usual paraphernalia of a president, vice-presidents, treasurer, members, general and sectional secretaries, all of whom serve in honorary capacities. Under the council are a number of sub-committees dealing with finance, library, publications, etc.

As has been mentioned in the introduction, the Society, since its foundation, has been functioning as an Academy of Sciences and of Humanistic Studies. However no special qualifications, academic or research, are necessary for election to the membership of the Society; interest in the activities of the Society is considered sufficient. Consequently the Society has the dual rôle of an Academy, as well as one similar to that of the Royal Institution of London.

The Society discharges its responsibilities (*i*) by holding meetings, (*ii*) by its publications, and (*iii*) by maintaining a library and a museum.

Meetings: These are of two kinds, *e.g.*, regular monthly meeting for the transaction of routine business and for the reading of communicated papers, and a series of popular lectures on subjects of scientific and cultural interests which cater specially for the non-specialist members of the Society as well as for the interested public.

Publications: The papers communicated and accepted for publication, appear in the Journal of the Royal Asiatic Society (Letters and Science); the present series is the third one from 1935-1951. Its predecessors were the Asiatic Researches 1788-1839, Journal 1st series 1832-1904; Proceedings 1865-1904. The Journals and Proceedings were amalgamated and formed the second series 1905-1934.

A Memoir series was started in 1905 and discontinued since the last war. It will be seen that the Society has been maintaining since 1788, either directly or through its patronage, a medium for the publication of research papers. Before the establishment of scientific surveys and scientific departments and the foundation of scientific societies, each with its own medium of publication, the Society's Journals and Memoirs were the principal channel of communication for studies in physico-mathematical sciences, the natural and social sciences including meteorology, chemistry, geology, mineralogy, botany, zoology, ethnology, etc.

Bibliotheca Indica represents the most important of the Society's publications. It consists of a series of oriental texts in Sanskrit, Arabic, Persian and other Eastern languages with their translations. The series now includes several hundreds of individual works, the total number of fascicles published to date being nearly 2500. The record of the Society in advancing the study of Sanskrit Persian, Arabic and even Tibetan has not probably been surpassed by any other organization devoted to the study of any one classical language. The Society has also pioneered the study of Tibetean and Tibetology.

Library and Museum: The library of the Society which has grown steadily since its inception has a rich collection of rare and valuable books and manuscripts, of which references will be made under 'Libraries in Calcutta' (Section III).

The extensive collection of coins, ethnographic materials, minerals, economic products, etc., started by the Society in 1814, was handed over to the Government of India in 1865, with the object of using it as nucleus for an Indian Museum. The Society still retains a collection of copper plate inscriptions, and a few thousand coins collected after the previous one had been handed over to the Museum in 1906.

Contribution to Scientific and Humanistic Studies: As mentioned previously, in the early days the Journal of the Society provided the sole medium for the publication of the scientific investigations carried out in this country. Amongst the eminent scientists who as members of the Society contributed to the Journal, the names of the following may be mentioned: Voysey, the father of Indian Geology; Oldham who started the Geological Survey; Lambert who was responsible for the initiation of the Trigonometrical Survey of India and its first Superintendent; Newbould, a famous geologist of his period; Schwendler, one of the principal founders of the Zoological Gardens; Roxburgh and Wallich, Superintendents of the Indian Botanic Garden and noted contributors to botany, Fayrer and Dillon, well known for their researches in ethnology of India.

The Asiatic Society was responsible in other ways for the furtherance of scientific survey of this country. Based upon its own record of scientific work, the Society was in a position to advise the Government of India, whose headquarters was then in Calcutta, on the question of institution of scientific surveys and departments. Based on the advice given, the Trigonometrical Survey was started in 1818, the Geological Survey in 1851, the Indian Meteorological Department in 1875, the Botanical Survey in 1890, and the Zoological Survey in 1916. The Council of the Society often contains members of these surveys, and there is always a close cooperation.

The Indian Science Congress was started in 1913 on the initiative of the Society, and the first meeting was held in the latter's rooms. Following the growth of the Science Congress, many scientific societies have been started, each with its own journal. With the foundation of the National Institute of Sciences of India which for several years had its headquarters in the rooms of the Asiatic Society, there have been further restrictions on the functions of the Society. The National Institute, after its removal to Delhi, has been recognized as the official mouthpiece of the scientists of this country and is on occasions consulted by the Government on important matters of scientific policy. Unlike the National Institute, the Asiatic Society has up till now been an entirely non-official organization more on the lines of the Royal Society of London.

The scientific investigations fostered by the Society were mainly of an applied basic character, started with some idea of making, by means of surveys, the administration of the country more efficient and of utilizing the natural resources of the country. The pioneering humanistic studies of the Society opened out new vistas of investigations, one of which as mentioned in the introduction, led to the growth of the new discipline of comparative philology. The Society's path finding contributions to the study of history, art, archaeology, of epigrapy, paleography and numistatics, of religion, philosophy and folk lore, have led in course of time to fundamental discoveries, comparable in many ways to the discoveries of European scholars in Greece, Egypt and the Middle East. The decipherment of the Bramhi script by Prinsep in 1837 at the Asiatic Society was of basic importance in epigraphical and paleographical studies. The archaeological researches of the Society led to the starting of the Archaeological Survey.

Conclusion: An account has been given above of the rôle of the Asiatic Society in the initiation and development of studies both scientific and humanistic as well as to the gradual supplanting of its activities by the growth of vigorous scientific organizations, most of which directly or indirectly owe their formation to the initial efforts of the Society. It appears to us that the Society should explore new lines of activity, more suited to the altered circumstances. Two such lines appear feasible: (*a*) In science its rôle will be that of a regional academy. When the contemplated building programme has been accomplished, accommodation may be provided to the many scientific societies with headquarters in Calcutta. The latter will be benefitted by obtaining rooms in a central locality, the journals received by them in exchange may be housed together and utilized to the advantage of all participating societies; while a common administration may more efficiently run the business side of editing, proof reading, printing, collection of subscription, etc. A common habitation will help the holding of symposia on borderland problems in which more than one science is involved, and will lead to the initiation of team work in the attack of such problems. (*b*) The Society had during the period 1935-51 adopted the title of the Royal Asiatic Society of Bengal. Last year it was decided to drop the prefix 'Royal' and the suffix 'of Bengal'. The Society will again be known by the name given by the founder, "The Asiatic Society"; there will then be nothing to prevent its regaining the previous all India character. Considering the rôle of the Society in pioneering humanistic studies, its traditions and accumulated treasures in books and manuscripts, etc., we do not see any reason why the Society should not obtain recognition as the Central Academy for Humanistic Studies.

Presidency College

Presidency College is the continuation, under the present name, since 1855, of the Hindu College founded in 1817. Teaching in science was introduced first in 1824 but a properly equipped chemical laboratory really started in 1873 when Sir Alexander Pedlar brought with him equipments from England. Physics, biology and geology were progressively introduced. All the laboratories were either housed in the main building or in tin shed extensions till the construction of the

Baker Laboratory was finished during 1912-13, where the physics, biology and geology departments are now accommodated.

As mentioned in the introduction, the first significant contributions by Indians to scientific research in Bengal originated from the Presidency College. This institution has the distinction of having had three Fellows of the Royal Society on its staff, one Englishman Sir A. Pedlar and two Indians Sir J. C. Bose and P. C. Mahalanobis. Pedlar's investigations (1880-1890) were on snake venoms, chlorine and chlorine acids. This tradition of research were continued in the chemistry department by P. C. Ray who built up a very productive school of chemists. J. C. Bose's first paper on polarization of electric waves was communicated in 1895 to the Asiatic Society of Bengal. He established a precedence by passing on from investigations on physics to plant physiology and after his retirement he founded the Bose Institute to carry on his researches. This precedence has been followed up by his successor in the chair of physics, P. C. Mahalanobis, by starting an important series of investigations in statistics which led him to start the Indian Statistical Institute in 1931. A brief review of some of the researches carried out in the different departments is given below. Considering that the staff has the responsibility of teaching both under-graduate as well as post-graduate classes, their record of research is very creditable. Grants-in-aid for some of these investigations are received from the Government of India and the Government of West Bengal, I.C.A.R., I.C.J.C., B.S.I.R. and A.E.C.

Mathematics: Investigations in mathematics include studies on non-Euclidean geometry (S. Mukhopadhaya), on matrices and determinants (C. E. Cullis), differential geometry and hydrodynamics (B. M. Sen). Investigations have also been carried out on summability of series and integrals, higher plane curves, elasticity, relativity etc.

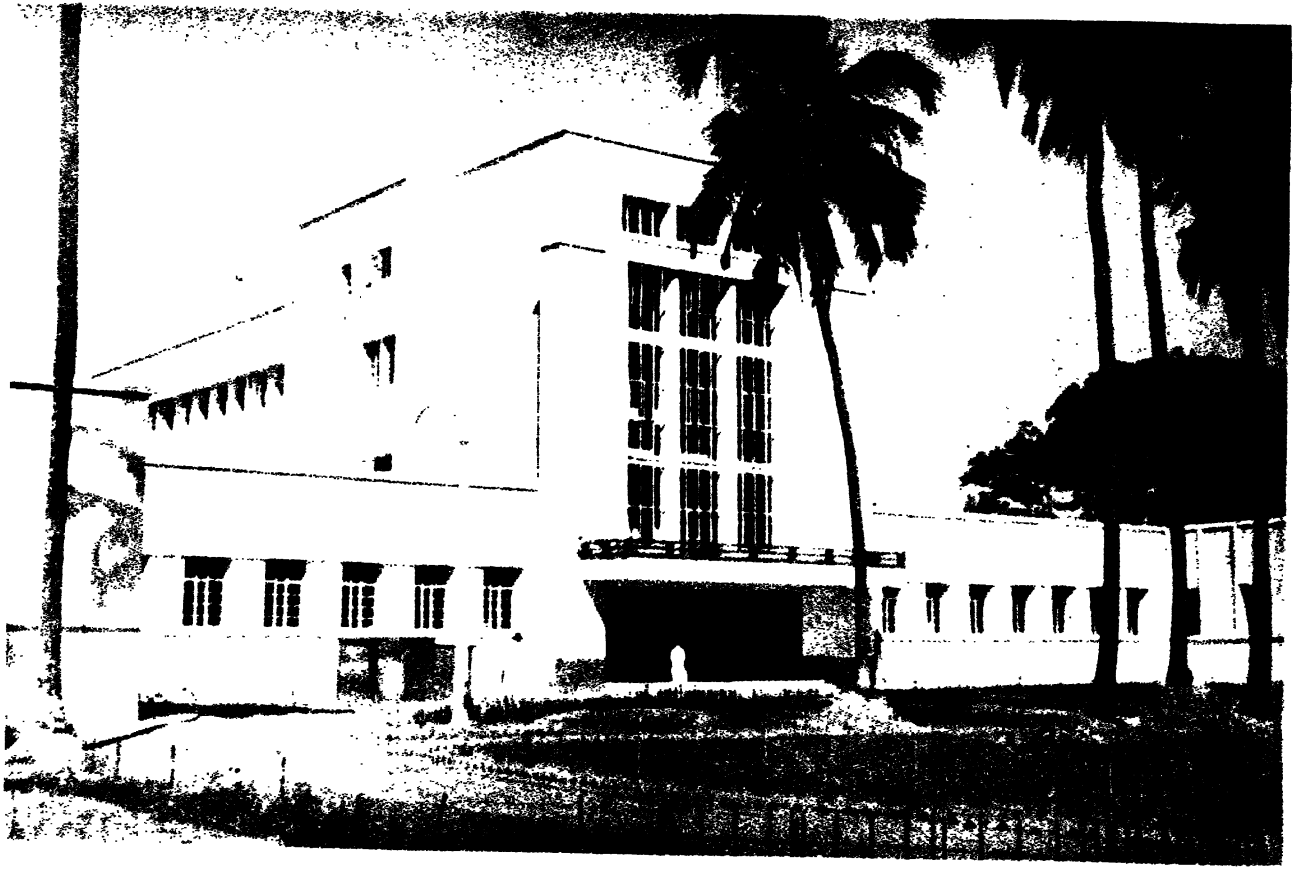
Based upon the statistical researches initiated by P. C. Mahalanobis, a new Department of Statistics has been started in 1949 and investigations on several important subjects are being carried out, of which an account is given later.

Physics: In addition to J. C. Bose's investigation on short electric waves, investigations have been carried out by D. N. Mallik on electric discharges in de la Rue discharge tubes, on spectroscopy, and on cosmic rays. K. C. Kar has published a number of papers on theoretical physics, on applications of different statistical theories including his own wave statistics, to the deduction of (*i*) Bose-Einstein and Fermi-Dirac distribution and Planck's formula, and (*ii*) alpha-particle disintegration etc.

Chemistry: P. C. Ray's investigations on nitrites and hyponitrites are well known. A subsequent band of chemists have published investigations on stereochemistry of nitrogen compounds; electric condition of nascent gases, heterocyclic compounds; synthetic dyestuffs; aromatics, hydrocarbons; fluoberyllates and certain compounds from beryl etc.; flavanones, indole and acridine derivatives; synthetic coumarine and chromones; and on stereochemistry of cyclohexane ring and spiro compounds; etc.

Botany: In the department of botany contributions have been made to

PRESIDENCY COLLEGE, BAKER LABORATORY



INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE, JADAVPUR the subjects of (*i*) plant physiology, photoperiodic effects and its seasonal variations in jute, tobacco, mustard, etc., mineral nutrition of plants as studied by sand and water culture methods by J. C. Sen Gupta; (*ii*) developmental anatomy, of various types of stipules, anatomy of pulvini of sensitive plants etc.; and (*iii*) cytogenetics of pulses, and breeding of rice.

Geology: H. C. Das Gupta carried on a series of palaeontological studies on fossil invertebrates, fish remains and dinosaurian bones; later he took up petrological and mineralogical studies. Other studies include metamorphism in Eastern Himalaya, petrology of Rajmahal lavas and of other minerals, stratigraphy of the Kolhans etc.

In 1951, a separate department of geography in charge of Prof. N. R. Kar has been opened. Investigations on the agricultural belt of West Bengal, urban geography of Calcutta are amongst the subjects being dealt with.

Physiology: The department was started in 1900 by Prof. S. C. Mahalanobis; post-graduate classes were opened in 1911. Amongst the investigations carried out, mention may be made of Katathermotric conditions in the laboratory during different seasons, the effect of cobra venom and some compounds of stibamine on heart beat; chronaximetric studies on, hormones and vitamin A and B deficient persons; effect of vitamin C on fatiguability of muscles etc. Other investigators (S. Banerjea *et. al.*) have studied the biosynthesis of niacin, effect of ascorbic acid and niacin on carbohydrate metabolism etc.

Indian Association for the Cultivation of Science

Brief History: The Indian Association for the Cultivation of Science, the oldest scientific research institution in India, owes its inception to Dr. Mahendralal Sircar, a leading medical practitioner, a scientist by temperament and a great visionary. In an article published in the *Calcutta Journal of Medicine* in August 1869, Dr. Sircar first advocated the idea of founding a research institution with libraries and laboratories where young Indians could be offered facilities for research and instructions in sciences. He was encouraged in this idea by the then leading educationists and prominent citizens of Calcutta. These men not only helped Dr. Sircar with counsels but contributed handsome donations with which it was possible to found India's first non-official scientific research institution in 1876. The history of the foundation of the Association is also the history of the rise of a scientific movement in the country, started under Indian initiative. It represents the first of a series of fine research institutions established throughout this sub-continent.

During his own life time, Dr. Sircar was able to develop the Association as a teaching institution in sciences, but could not build it as a research centre as he had originally planned. This task was accomplished by Prof. C. V. Raman who joined the Association in 1907, as a young graduate from the Madras University and Officer of the Finance Department of the Government of India. The scientific genius of Raman and the facilities of the Association combined to usher in a new chapter in the institution's history and within a few years

'210, Bowbazar Street' attracted research workers from all over the country. The Association bristled with research activities in acoustics, optics, x-rays and magnetism. In 1924, Prof. Raman was elected to be a Fellow of the Royal Society and in 1930 awarded the Nobel Prize in physics for his discovery in 1930 of a new effect in light scattering, known as the Raman Effect.

Prof. Raman left the Association in 1933 and was succeeded by Dr. K. S. Krishnan, who had his early research training under Raman at the Association, as the first Mahendralal Sircar Professor. This Professorship was created with the princely donation of Rs. 1,00,000 from Rai Bahadur Veharilal Mitra and the accumulated funds of the Association. For his work carried out at the Association on crystal magnetism, Dr. Krishnan was elected to a Fellowship of the Royal Society of London.

New Development Plans: During the post-war years, the Committee of Management (now the Council) realized the need for reorganizing and extending the activities of the Association so that it might play an increasingly important part in fundamental researches in molecular physics, a branch of science in which the Association had established an unrivalled reputation. A new Development Plan worked out by the Committee envisaged the creation of an active research school for the study of the physics and the chemistry of high polymers, in addition to fundamental studies in x-rays, optics, magnetism and Raman Effect in which the Association had specialized over several years. The old building and space available at 210, Bowbazar Street proved inadequate for embarking on any such programme of research and plans were accordingly made for the acquisition of a large plot of land and constructing a new building.

In 1947, the Government of India provided for an annual recurring grant of Rs. 2,66,700 towards implementation of the new plan. During the last four years, the Association established by and by six research departments, namely, X-rays and Magnetism, Optics, Physical Chemistry, Organic Chemistry, Theoretical Physics and Inorganic Chemistry. Each research department is in charge of a Professor or a Reader and staffed by research and technical officers, assistants and senior and junior scholars. The library which has perhaps one of the best collections of scientific journals and periodicals pertaining to physical sciences in India, has been considerably expanded and so has been the workshop.

The Association's building plan materialized through the handsome grant of Rs. 4.32 lakhs by the Government of India and Rs. 7 lakhs by the Government of West Bengal and an interest-free loan of Rs. 5.8 lakhs again from the Government of India. A plot of land covering nearly 29 bighas, near the buildings of the College of Engineering and Technology and the Central Glass and Ceramics Research Institute, was acquired at Jadavpur in 1947. The construction of the laboratory building was taken up early in 1949 and by the end of 1950, the ground floor, the Assembly Hall, the Library, the Workshop, the Cryogenic Laboratory and several minor constructions were completed. At the beginning of 1951, the research laboratories, library, workshop and the office were shifted to the new building from its old premises at 210, Bowbazar Street, where the Association had functioned for about 75 years. The successful implementation of the Development Plan has been, in large measure, due to the energy, effort and drive of Prof. M. N. Saha, President of the Association from 1946 to 1951.

Research Activities: During the time of Raman, problems relating to acoustics, vibrations of stringed instruments, musical tones etc., interference and diffraction of light, Rayleigh scattering, birefringence due to electric and magnetic fields, magnetic susceptibilities of gases, liquids and solids, x-ray diffraction in liquids and solids were investigated. Raman's investigation with the scattering of light led to the observation of a new kind of 'weak fluorescence' which, on close analysis, turned out to be a scattered radiation with changed wave length. This phenomenon observed for the first time henceforward came to be known as Raman Effect. Dr. K. S. Krishnan developed new techniques for the measurement of magnetic susceptibilities and anisotropy of a large number of organic and inorganic crystals. Krishnan and his students and collaborators studied the properties of paramagnetic crystals, the magnetic properties of graphite, magnetic double refraction etc., which greatly contributed to the understanding of the nature of crystalline fields.

The investigations now being carried out at the Association are far too numerous and diverse to mention in a brief note. In the Department of X-rays and Magnetism, Prof. K. Banerjee, the Mahendralal Sircar Professor and his students are engaged in the study of the crystalline structure of organic compounds, the determination of elastic constants of crystals from the study of diffuse reflections of x-rays, study of glass, extra reflections in Laue photographs, x-ray investigation of coal, crystal magnetism, studies on semi-conductors and production of low temperatures. Prof. S. C. Sirkar and his students of the Department of Optics have continued investigations in the field of Raman spectra. Some of their recent studies include origin of low-frequency Raman lines due to organic compounds in the solid state, Raman spectrum excited by resonance line of mercury, and fluorescence and absorption spectra of diamond. Recently they have carried out a series of investigations on the absorption of ultra high frequency radio waves by organic liquids. In the Department of Physical Chemistry, problems relating to high polymer chemistry are under study by Prof. S. R. Palit and his students. These investigations include chain transfer studies in vinyl polymerization, cellulose chemistry including benzyl cellulose and triphenyl methyl cellulose. Measurements of dielectric constants and dipole moments, inductor studies in non-aqueous solvents, non-acqueous titration of acids and bases have also been investigated. Synthesis of phenanthrene, polyphenyls, gonadogens, antibiotics, anticarcinogens are some of the broad subjects on which work has been carried out by Dr. S. M. Mukherji and his collaborators and students in the Department of Organic Chemistry. Dr. D. Basu of the Department of Theoretical Physics, organized only last year, carried out investigations on problems relating to the relativistic scattering of neutrons by protons.

Scientific Publications, Medals and Professorships and Prizes: The Association publishes the *Indian Journal of Physics and the Proceedings of the Indian*

Association for the Cultivation of Science, an Annual Report and special publications based on lectures delivered by Cooch-behar and Ripon Professors and Joy Kissen Mookerjee Medalists.

The Association's *Dr. Bimala Churn Law* Gold Medal and *Joy Kissen Mookerjee Gold Medal* are offered to scientists who have made conspicuously important contribution to science. Some of the recipients of the medals are Prof. A. Einstein, Sir Henry Dale, Sir Robert Robinson, Sir Alexander Fleming, Prof. Robert Millikan, Sir E. J. Russel, Sir James Jeans, Mme. Irène Curie, Dr. S. S. Bhatnagar and others.

Management: The affairs of the Association are governed by a Council of 24 members which include representatives of the Government of India, Government of West Bengal, the National Institute of Sciences of India, the Trustees, the Staff Committee and members elected by the Life and Ordinary Members of the Association from amongst themselves. There are about 250 Life and Ordinary Members of the Association. The present President is Dr. J. C. Ghosh.

University College of Science and Technology

The details regarding the foundation of the University College of Science with its complement of University and Endowed chairs have been dealt with in a previous article. Here we shall be concerned chiefly with the reviewing of the research activities of the different departments of the Science College. Some of them Applied Mathematics, Pure and Applied Physics, Pure and Applied Chemistry, Physiology and Experimental Psychology are located at 92 Upper Circular Road, while the Departments of Botany, Zoology and Anthropology are located at 35 Ballygunge Circular Road, in the residential quarters of the late Sir Taraknath Palit. The University authorities have not yet been able to make up their minds about the future location of these departments. As a consequence these departments are badly housed, lacking space for laboratory extension. The old structure at 92 Upper Circular Road, also a gift of Sir T. N. Palit, was pulled down and a huge 3 storied building erected in its place which housed all the departments. Separate structures, some of which are still in the process of erection, are being raised to house the departments of Applied Physics, Applied Chemistry, and very recently separate buildings have been constructed for the Institute of Nuclear Physics, and the Department of Radiophysics and Electronics. The two new departments *viz*,. Geography and Statistics are housed in the Senate House and the Asutosh Buildings respectively while the Department of Geology is located in the Geology department of the Presidency College.

The first appointments were made in 1914, of C. V. Raman as Palit Professor of Physics, while P. C. Mitter, D. M. Bose and S. P. Agharkar were appointed Ghosh Professors of Chemistry, Physics and Botany respectively. The latter two, Bose and Agharkar, were deputed for further studies to Germany in 1914, from where due to the outbreak of war their return home was delayed till 1919 and 1920 respectively. One of the most striking results of the foundation of the Science College was the opportunity which was provided to a batch of brilliant young men to strike out along different branches of investigations and to achieve distinction. They all graduated from the Presidency College, and but for the opportunity given to them in the Science College, their talents would have been either frustrated or diverted to other channels. Two factors which attracted them to a life of research were (i) the swadeshi movement which made them averse to entering Government services and (*ii*) the examples of J. C. Bose and P. C. Ray with their pioneering scientific investigations.

We shall now give summaries of the principal investigations carried out in the different departments of the Science College.

Physics: C. V. Raman's researches were carried out mainly in the laboratories of the Science Association and have been described in a previous section. When Raman resigned in 1933 to become the Director of the Indian Institute of Science, Bangalore, D. M. Bose succeeded him as Palit Professor. He in turn resigned in 1938 and was succeeded by the present incumbent M. N. Saha. D. M. Bose's initial investigations were photography of tracks of ionizing particle in a Wilson Chamber, especially of nuclear collision between α particles and those of hydrogen and helium. He then took up theoretical and experimental investigations on the paramagnetic moments of ions belonging to the different transition groups of elements. These led to the formulation of what is known as the Bose-Stoner theory. Later he proposed an empirical formula which enabled the calculation of the magnetic moments of such ions in co-ordination compounds. These empirical formulas were later generalized in the theories associated with the names of Pauli, Hund and Van Vleck.

His next investigation was on the origin of colour of paramagnetic ions including those belonging to the rare earth group. He measured the change in magnetic moments of these ions in solution, due to light absorption.

M. N. Saha, while lecturer in physics, published an important series of papers applying the theory of temperature ionization of known elements as a method for determination of stellar temperature. He has, in collaboration with others, made important theoretical studies (*i*) on the distribution of electrons bound in different shells of atoms based upon x-ray data; this work was done in collaboration with B. B. Ray, (*ii*) a magneto-ionic theory of reflection of radio waves from Heaviside layers, (*iii*) on the stability of nuclear isomers etc.

He has been responsible for extending facilities for fundamental research by obtaining grant from the Central Government and also from private donors, with which the construction of the Institute of Nuclear Physics was made possible.

S. N. Bose, before he went to Dacca as Reader and subsequently as Professor of Physics of the Dacca University, was on the staff of the Physics Department. He has come back as Khaira Professor of Physics and is in charge of the X-ray Department, which was started by the late B. B. Ray and many important publications have appeared from his school.

His chief contribution to theoretical physics has been the deduction of Planck's law of spectral distribution of energy in black body radiation by considering only the particle aspect of photons. This result was extended by Einstein, and shown to be applicable to the statistics of gas particles with no spin moments. It is now known as Bose-Einstein Statistics. Bose's other investigations have been in applied mathematics, statistics, and organic chemistry.

P. N. Ghosh, S. K. Mitra and B. B. Ray, while lecturers, obtained their D.Sc. degrees by investigation on different optical problems. P. N. Ghosh was appointed Professor of Applied Physics in 1925, and was responsible for the organization of the department. He installed a 21 ft. concave grating and also a complete equipment for infrared spectroscopy. He and his students published a large number of papers on molecular spectra (further details are given in "Engineering and Technological Education and Research").

S. K. Mitra is at present Ghosh Professor of Physics and Head of the newly opened Department of Radiophysics and Electronics. His wireless laboratory was the first of its kind established in India. The main line of investigations has been on the properties of upper ionized regions of the atmosphere, the Ionosphere, which has resulted in the discovery of the D-layer below the F and E layers. Further details are given in 'Engineering and Technological Education and Research'.

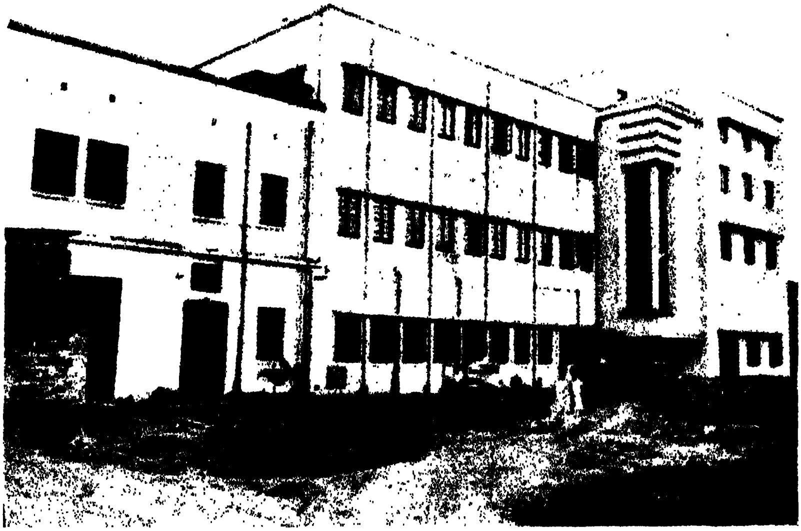
B. B. Ray spent some years in Prof. Siegbahn's laboratory in Uppsala and in Bohr's laboratory in Copenhagen. He did some valuable investigations on x-ray spectroscopy especially of the lighter elements. After his return, he established a well equipped x-ray laboratory, and a large amount of investigations on the shifts of the absorption edges of an element resulting from the nature of its bond in a compound have been carried out. He observed an absorption band shift to the longer wave length side of the K absorption edge in graphite, which he thought was analogous to Raman shift. This he could not always reproduce. Later on in the X-ray laboratory, a similar shift on the longer wave length side of the K-edge of the absorbing element was observed in the compounds of lighter elements, which established it as an x-ray analogue of Raman shift.

Chemistry : The Department started with the appointment of two endowed professors, Sir Taraknath Palit and Sir Rashbehary Ghosh Professors of Pure Chemistry. On the invitation of the late Sir Asutosh Mookerjee, Dr. P. C. Ray, who was at the time the Professor of Chemistry in the Presidency College, Calcutta, retired from the Government service and joined the University College as the first Palit Professor of Chemistry. Dr. P. C. Mitter, who was closely associated with the design, construction and equipment of the laboratories, became its first Ghosh Professor of Chemistry. A third endowed professorship in Chemistry, namely the Guruprasad Singh of Khaira Professorship, was created subsequently after about five years. Dr. J. N. Mukherjee, who had joined the Department of Chemistry as a post-graduate lecturer at the time of its opening, was appointed on his return from England as the first Khaira Professor of Chemistry. With the appointment of other young brilliant scholars as assistant professors and lecturers, all the three sections of chemistry, inorganic, organic and physical, may be said to have been very well represented.

UNIVERSITY COLLEGE OF SCIENCE & TECHNOLOGY (UPPER CIRCULAR ROAD)

UNIVERSITY COLLEGE OF SCIENCE & TECHNOLOGY (BALLYGUNGE)

BOSE INSTITUTE



INSTITUTE OF NUCLEAR PHYSICS

Prof. P. C. Ray took charge of the section of inorganic chemistry, Prof. Mitter of that of organic chemistry, and Prof. Mukherjee initiated research work in physical chemistry. Within a short time the Department earned a reputation as an important centre of chemical researches in India. By way of illustration, it may be stated here that in the first number of the *Journal of the Indian Chemical Society,* which came out in November, 1924, after the foundation of the Society, there were altogether thirteen papers of which four emanated from the Department of Chemistry of the College of Science, Calcutta. Commenting on this, the well-known British scientific journal, *Nature,* wrote " this is as it should be, because, for many years past, this institution has been the backbone of chemical research in India ". This reputation, it may be said, the Department has not possibly failed to maintain till now.

In the section of inorganic chemistry, P. C. Ray and his co-workers paid special attention to the study of the complex compounds of noble metals like gold, platinum, iridium, etc., with mercaptans, and organic sulphides. He was ably supported by the other colleagues of his section, who have developed many other interesting lines of work, leading ultimately to many fruitful results. The section may now claim to have made important contributions to the study of co-ordination compounds, chemistry of the rare earths, magneto-chemical studies of valency and structure of chemical compounds, spectroscopic studies and analysis, and analytical chemistry (macro- and micro-) by both classical and instrumental methods. Many of the publications from this section have met with due recognition in the international literature of chemistry. The activity of the section is now thoroughly extended in working upon problems related to all the abovementioned branches of study.

Prof. P. C. Mitter and co-workers occupied themselves mostly with the synthesis of natually occurring anthraquinones and of long chain of the type of aleuritic acid. Studies in γ ketonic acids constituted another subject of their research. His pupils, colleagues and successors in the section of organic chemistry extended their field of research in many other important directions with great success. Significant contributions have been made from this section towards the synthesis of a number of natural terpenes and their degradation products, to the study of steroids and related problems, to the chemistry and syntheses of phenanthrenes and hydrophenanthrenes, chemistry of coumarins, chromones and related compounds, as well as to the study and investigation of Indian plant products. The publications from this section have received due recognition abroad. Intensive investigations are now being pursued in this section on all the problems noted above.

In the section of physical chemistry, Prof. J. N. Mukherjee and his pupils initiated investigation on colloids, relating to their stability, coagulation and surface characteristics. The electrolytic colloids, particularly clay and clay minerals, formed a special subject of their study. These have led to a clarification of important processes like base exchanges, soil acidity, etc., on the basis of the theory of the electrical double layer postulated by Mukherjee. Valuable contributions have also been made by Mukherjee and his pupils on the colloidal behaviour of drilling mud including thixotrophy, swelling, etc., which finally developed into studies in soil chemistry. These lines of study have been successfully maintained by the pupils and successors of Prof. Mukherjee since his departure from this college. Apart from the international reputation of the work carried out in this section, it might be mentioned that, in recognition of the practical value of the work carried out by Prof. Mukherjee and his co-workers, the authorities of the Burmah Oil Company made a handsome donation to the Calcutta University with which the present Colloid Chemistry Laboratory was built up.

Recently a contribution of Rs. one lakh was received from the Government of India for the purchase of special instruments and apparatus, as well as for other equipments, for promotion of research and teaching in this Department. Many schemes of research work financed by the Government of India, as well as by private Industrial Organizations, have been carried out and are being continued in this Department. The activity of the Department in all its sections has now been fully maintained and, in fact, plans for further development and expansion are under close consideration.

Geology: The post-graduate department was started in 1916 and since then housed in the Geology Department of the Presidency College. The number of students in the department starting from a small beginning now averages to about twenty. Lack of accommodation prevents the admission of a large number of students. At present the department is under the charge of Mr. N. N. Chatterjee, with five whole time teachers. In the beginning investigations were carried on crystallography, palaeontology, economic and applied geology, ore microscopy origin of mica etc. Three research scholars are now engaged in investigation of problems bearing on ore microscopy and petrography.

Zoology: The department is located at 35 Ballygunge Circular Road, and was started in 1919. The first professor was Prof. S. N. Maulik ; he only stayed in Calcutta for a short period, after which he returned to London and resumed his investigation in the insect department of the British Museum. He became a world authority on Chrysomelideae (beetles), a family with 25,000 species. He died in 1950. The next professor to be appointed was Dr. B. K. Das who had done some excellent work on the breathing mechanism of ' Jeol ' fishes in Prof. McBride's laboratory in London. His tenure of professorship was from 1926-1931. He was responsible for the excellent equipment of the teaching laboratory. Prof. H. K. Mookerjee, the present incumbent, succeeded Dr. Das in 1932 and is responsible for many improvements both in the organization of teaching as well as of research. From the beginning the department was able to attract many able investigators, including Rai Bahadur Dr. G. C. Chatterji, already an authority in protozoology, when he joined the department in 1922 as honorary lecturer. The output of original investigation from this laboratory has been on a variety of subjects. It is possible only to indicate some of them briefly here.

Researches in vertebrate embryology have been conducted on the mode of development of vertebral column in *Urodela* and *Anura*. These investigations extending over two decades have definitely established the basic principle of the development of the centrum of a vertebra in the *chordate* series is the same, and that the structural complexity and modifications of different elements which go to form the axial skeletons are products of various manifestations of evolutionary forces.

Researches in fishes deal with the life history, bionomics and development of common Indian fresh water fishes. They were supported for a period of five years by an I.C.A.R. grant.

The entomological section under the charge of D. Mukerji, is suitably equipped for morphological, anatomical and embryological studies of various insects. Special facilities are available for field biological studies of insects of economic importance. Systematic studies on ants including those on the unidentified collections of ants in the Indian Museum and in the Forest Research Institute, Dehra Dun, have been carried out. In the field of economic entomology, valuable studies have been made on pulse beetles and tea bugs. D. Mukerji has suggested the possibility of control of the latter by means of a parasitic nematode.

A systematic study of parasitic helminths was taken up since 1931, and a number of papers have been published describing nematode parasites not previously known.

Studies in protozoology were started in 1922, and are being successfully continued up to the present time by a large number of workers.

Studies in cytogenetics were started in 1940. Chromosomes of many insect species have been described and their meiotic behaviour worked out. The effect of x-ray irradiation of the germ cells of grasshoppers has been studied, including chromosome breakage and bridge formation. An explanation has been given of the effect of low temperature in producing higher yields in the number of non-homologous association of bivalents. Some data on the frequency of chromosomal abnormalities in the wild population of grasshoppers have been collected, which have led to some interesting conclusions on the rare occurrence of inter breeding between two populations of the same species of grasshoppers which are only separated by a few miles.

Investigations have also been carried out on comparative anatomy and sex physiology.

Physiology: Post-graduates classes in physiology were started in 1911 in the Presidency College by Prof. S. C. Mahalanobis. The University classes were started in the Science College in 1939 with Prof. S. C. Mahalanobis in charge. He was succeeded in the following year by the present head of the department, Dr. B. B. Sarkar. This is the only post-graduate department of its kind in this country.

From the very start the department had to struggle with inadequate accommodation, insufficient grants etc. Recently a grant of Rs. one lakh was received from the Ministry of Education for development of teaching and research facilities. This, with the proposed extension of laboratory accommodation, will give a substantial impetus to the development of its usefulness. At present the laboratory is equipped for training and research in histology, experimental physiology, and biochemistry, and is shortly expected to offer facilities for investigations on aviation physiology and neurophysiology. A multichannelled electro-encephalography apparatus has been ordered from the U.S.A.

During the last two years, a large number of research papers have appeared from the department on nutrition, metabolism, vitamins, brain and nervous systems, endocrine organs, tissue culture etc.

Anthropology: The Department was started in 1920 and is now located at 35 Ballygunge Circular Road. From the beginning the Department was able to attract a number of able workers who had already been recognized as authorities in their respective subjects. Rai Bahadur R. P. Chanda was in charge when the department was started, but soon left to join the Archeological Survey of India. He was succeeded by Rao Bahadur L. Ananta Krishna Iyer, already known for his studies on tribal life in Cochin and in Mysore. Amongst his colleagues were Bijoy Chandra Mazumdar known for his studies of tribes of Sambalpur. Sarat Ch. Mitra, an authority on the folk lores of North Bihar, Dr. P. Mitra the prehistorian. K. P. Chattopadhaya, after a short period of service during 1924 left, and returned in 1937 to become the head of the department. Other well known members of the past and present staff are Nirmal Kumar Bose widely known as the disciple and biographer of Gandhiji, T. C. Das, P. C. Biswas and D. Sen. During the first period, investigations were confined chiefly to ethnology and physical anthropology. Reports were published on Hons, Kharias and Bhumij. Intensive field work on modern lines was taken up since 1932. Monographs have been published on investigations made on certain Assam tribes like the Purums and Chirum as well as on Bunas of Bengal. A report on Aimolkukis is ready for publication, while a series of studies on the Santals since 1938 is nearing completion. Some of these studies and reports have helped the authorities in Assam, Bengal, and the Central Provinces in their tribal administration.

A series of investigations amongst the more advanced populations of Bengal was initiated to study the famine condition in Bengal, starting from 1943. A report has been published under the title "The Bengal Famine".

Another series of investigations dealing with the problems of rehabilitation was published in a monograph under the title "A plan for Rehabilitation of Bengal". Studies of conditions of jute workers in the industrial belt will be published in a book "A Socio-economic survey of Jute labour". Most of the surveys were in collaboration with the Indian Statistical Institute and financed by the latter. The training given in the department and its value in economic and social surveys and planning of welfare work has been recognized by some Government departments and industrial concerns, by the appointment of past students as welfare officers. A large number have also been absorbed in the Anthropological Department of the Government of India.

The department possesses a well equipped laboratory for Somatometry, Craniometry and Osteometry. It has in its museum a representative collection of artefacts from prehistoric sites in India, as well as on ethnology.

Botany: Prof. S. P. Agharkar after appointment as Ghosh Professor of Botany in 1914 was sent to Germany for further studies. Due to the outbreak of War his return was delayed till 1920. In the meantime the post graduate department of Botany was started in 1918 with Prof. P. Brühl as University Professor and Head of the Department ; he published several papers on systematic studies of algae, mosses and flowering plants. Prof. Agharkar concentrated his attention to the teaching of systematic botany and plant geography. He made a valuable collection of plant materials from different parts of the country which now form part of the departmental herbarium and museum. He was also responsible for obtaining ICAR grants for cytogenetical investigations on mango and banana.

After Dr. Agharkar's retirement in 1946, Prof. P. C. Sarbadhikari of Ceylon University succeeded him. The latter is a cytologist who has to his credit several publications on cytological, genetical and anatomical studies on plants. He has made important contributions on the apogamy and apospory of ferns and continued the work on breeding of banana financed by the I.C.A.R.

A school cytogeneticists have been tackling different aspects of cytogenetical study with the aid of the improved techniques, particularly the chromosome-nucleolus relationship and the structure and behaviour of chromosomes with special reference to their bearing on the interpretation of phylogeny of plant groups ; to mention only a few, on the cytogenetics of *Cucurbits, Datura, Scilla, Oenothera, Eugenia, Grewia, Chenopodium* and *Lathyrus*. The raising of the stable tetraploid varieties of jute and crossing of the two of its common diploid species (hitherto regarded as incompatible) with the help of specially improvised method are notable attempts both from fundamental and economic point of view. Researches on cytogenetics of Mango, Banana, Potato and Jasmine have been carried out. The application of the theory of fragmentation of chromosomes in accounting for speciation in Cucurbits and Scitamineae has been widely appreciated. Application of modern cytochemical techniques for clarification of the chemical nature of different segments of chromosomes, specially the secondary constriction regions, are yielding promising results.

Paleobotanical research was introduced in the department as late as in 1937 when the anotomy of petrified wood mostly belonging to the younger beds was the focus of interest. Since 1942 the microfossil contents of coal and a wide variety of sedimentary rocks with reference to stratigraphy became the principal field of investigations. The fossil microflora have been variously put into test in Ranigunj, Cherra Stage (Assam), Saline Series and the associated Cambrian beds of Salt Range and elsewhere as an aid to stratigraphic problems often with conspicuous success. The botanical interest of such flora has also been studied. Besides some work has also been done on the nature and quality of diatomaceous earth and coal from their microfloral contents.

Important contributions from the plant physiology section are: on the water requirement and variation of sugar content, the effect of nutrient deficiency on growth and nitrogen metabolism on vernalization and photoperiodism in rice plants, which have been widely appreciated abroad. In the work on the effect of nutrient deficiency the importance of phosphorus in the nitrogen metabolism of rice plant was shown. Paddy soils might be rich in nitrogen but lack of proper amount of phosphorus leads to large vegetative growth, unfilled grains and reduced yield. Investigation on the flowering of rice plant include, the photoperiodic induction and the development of growing apex ; the interaction of temperature and day length on flowering of winter paddy and the growth hormone of rice grains germinated at different temperatures. An apparatus has been devised for the assay of growth hormones in plants, which eliminates the use of expensive air conditioned room, is now being used abroad for growth hormones experiments.

Valuable contributions have been made on the various aspects of plant embryology *e.g.*, on the development of gametophytes, endosperm and embryo formation, and on experimental embryology, on a wide range of plant families. Mention may be made of the contributions on *Costus, Monochoria, Eichornia, Gossypium, Typhonium* etc.

Experimental Psychology: The department was organised in 1919 by Dr. N. N. Sen Gupta who had received his training in Harvard University under Prof. Munsterberg. He resigned in 1929 after receiving a call to the Chair of Philosophy, Lucknow University, and was succeeded by Dr. G. S. Bose as Head of the Department. One of the lecturers of the Department, S. C. Mitra, went to Leipzig for advanced studies and after obtaining his doctorate degree returned and rejoined his post in the Department in 1929. On the retirement of Dr. G. S. Bose, Dr. S. C. Mitra was appointed Professor and Head of the Department in 1949. The section of Applied Psychology was formally opened in 1939; in this section investigations were carried out mainly in the fields of vocational psychology and mental testing. About the same time a complete revision of the syllabus was made and new branches of psychology such as Social psychology, Industrial psychology and Indian psychology were introduced. In 1945 training of students for a certificate course in Applied psychology was taken up, and in 1951 sanction has been accorded by the Government for a post-graduate course in Applied psychology.

A fair amount of first rate theoretical and practical work has been done by the members of the staff on problems relating to different aspects of perception, memory, instinct, psycho-physics and psycho-analysis. Several books on abnormal, child and general psychology have been written and a number of apparatus have been devised. Certain problems peculiar to Indian culture *e.g.*, Yoga, have been investigated. Special mention may be made of valuable researches on psycho-analysis which has won international recognition.

The Applied Psychology Section, of which Mr. S. K. Bose is now in charge, is engaged in carrying on researches on testing and rendering service to the public. The section has in hand the work of adaptation, construction and standardization of tests of intelligence, personality, and special aptitude. Group tests of intelligence have been prepared in English and Bengali; non-verbal tests have also been prepared. Tests of intelligence and aptitude have been given to students, seeking admission in the Medical and Engineering Colleges of Calcutta, and the follow-up results are being studied for examining the validity of the tests. A large number of boys and girls of school-leaving age have received vocational guidance, and careers of some of them are now being followed-up. Tests for the selection of personnel and for placement in different tracks have been given to some three thousand individuals in different industrial concerns around Calcutta. Job and worker analyses have been carried out as well as correlations between test scores and supervisors' ratings or outputs. Norms for performance tests are being worked out. The drivers of trams and State buses have been examined for detection of accident prone persons amongst them; this work is being done under the joint auspices of the University and the Indian Council of Medical Research. Pilot surveys of workers' attitudes in several factories have been made, and enquiries as to what workers want in their jobs have been conducted with the assistance of research students of the department. S. K. Bose, who recently visited the United States with a Unesco fellowship for studying 'human relations in industries', has started a small scale investigation of the problem of group tensions in two factories with the co-operation of the managements and labour unions. Plans are being made to start a programme of preparing objective educational tests.

Bose Institute

The Bose Institute was founded in 1917 by Sir J. C. Bose for the study of 'the nascent science which includes both life and non-life'. The special aim of the Institute has been to make a comparative study of responses to stimulation in different living organisms, in order to establish the essential unity of the life phenomenon underlying the diversity of its manifestation in plants and animals. Even during the Founder's life time the scope of investigations carried out in the Institute was considerably expanded, to include departments of theoretical and experimental physics, chemistry including agricultural chemistry and chemistry of plant products, plant and animal physiology, zoology and anthropology.

At present the Institute contains the following departments: Physics and Biophysics ; Applied and Biochemistry ; Plant Physiology, Cytogenetics ; Microbiology ; Zoology.

Location: The work of the Institute is carried out principally at 93/1 Upper Circular Road, Calcutta where the main laboratories, workshops and library are situated. Field investigations are carried out in the Agricultural Experiment Station at Falta, 32 miles south of Calcutta. Negotiations for the acquirement of 58 bighas of *Khas mahal* land near the Experiment Station is under way. At Bamangachi, 17 miles to the north of Calcutta, about 10 bighas of land has been taken on short lease to tide over the present shortage of land for field trials.

At Mayapuri (7,000 ft.), Darjeeling, Sir J. C. Bose carried on a number of plant science investigations. Since then a number of cosmic ray investigations have been carried out here and at Sandakphu (12,000 ft.). Plans for concentrating the cosmic ray investigation at Mayapuri have been hampered due to several causes, including the last war, partition and recent landslides in Darjeeling. At present an I. C. I. research fellow and a scholar are carrying out investigations on the potato virus diseases and soil microbiology. A glass house has been specially fitted up for the purpose.

Sources of income: The total income of the Institute for the current year will be about Rs. 3 lakhs derived from (*i*) invested funds Rs. 48,000, (*ii*) Government of India grant of Rs. 1½ lakhs, and (*iii*) grants-in-aid of about Rs. 1,06,000.

During the last three years, the Institute has received special grants (*i*) from the Government of India amounting to Rs. 1,80,000 and (*ii*) from the Trustees, Sir J. C. Bose Trust Fund No. I, amounting to about Rs. 1.20,000. The major portion of the grants received are being utilized for construction of new laboratories, equipment of workshop and purchase of instruments.

Grants-in-aid: The Institute receives grants from (*i*) the Atomic Energy Commission for research in cosmic rays and nuclear physics, (*ii*) from the Indian Central Jute Committee for production of economically desirable mutants by x-ray irradiation of jute seeds and for treatment of bleached jute fibres with synthetic resins, (*iii*) the Government of West Bengal for the breeding of improved strains of cotton, by selection and hybridization, and (*iv*) from the Central Oilseeds Committee on x-ray irradiation of sesamum and mustard seeds for induction of desirable mutants.

A grant offered by the ICAR for field trials of herbicides and weedicides, is under consideration.

Recent Researches: A short account of some of the important researches carried out in the Institute after the demise of Sir J. C. Bose is given below.

Plant Physiology: This is a continuation of Sir J. C. Bose's investigations, mainly from the biochemistry side. According to Bose the plant receives stimulation from its environment, like gravitation, light and mechanical contact etc., and proceeds to respond mechanically in a characteristic way,—bioelectric field of a definite polarity always accompany such response. In sensitive plants, the stimulation is transmitted as electric excitation and produces characteristic mechanical responses in the pulvinus and leaf system. Under certain conditions the energy of stimulation can be stored up to give multiple responses (in *Mimosa*) or spontaneous pulsations (in *Desmodium*).

Recent investigations carried out in the Institute show that in every instance between reception of external stimulus and resulting response a series of metabolic processes take place involving the release of stored chemical energy which is utilized for mechanical work of response. There are two factors involved: (*i*) a bioelectric field, local or propagated, arising from the act of stimulation, and (*ii*) a resulting chemical reaction, in which an auxin or a hormone plays the key role of acting as a prosthetic group to an enzyme; this activity is controlled by the bioelectric field. For the irreversible tropic responses, the auxin indole acetic acid is necessary and for the reversible contraction of pulvini of mimosa etc., a plant hormone of a not yet fully determined character is the mediator. A research fellow of the Institute is at present working on the chemical elucidation of this hormone in Germany.

The energy of spontaneous pulsations of the *Desmodium* leaflets has been shown to be derived from the breakdown of carbohydrate synthesized in the leaflet itself by the action of sunlight. It is known that an isolated heart in a tonic solution can perform such pulsation at the expense of stored glycogen. Both the tissues are myogenic ; while the transmission of excitation in a pulvinus petiole system of mimosa is similar to that in a nerve muscle unit of an animal. The similarity of responses in certain plant and animal tissues thus appears to be due to a similarity in the underlying biochemical mechanisms.

Cytogenetics: An important work of this department is the study of the mutagenic action of different radiations like x-rays, ultrasonics, ultraviolet etc. in producing desirable mutants in a number of economic plants like jute, cotton, and oilseeds. X-rays have been found to be the most successful agent for this purpose. Jute having been investigated for the longest period has given most significant results. The following new mutants appear to have been stabilized : (*i*) a tall mutant with heights and basal diameters significantly greater than those in the controls, (*ii*) a multistemmed mutant where the branching starts right from the bottom ; each stem being equivalent to a single stem plant for the yield of jute fibre, and (*iii*) an early flowering mutant.

Promising results have also been obtained by irradiation of cotton and oilseeds (sesamum). They are in the process of stabilization. Effect of ultrasonic radiation on seeds and plant roots has been studied. While the radiation produces morphological alteration in cell nuclei, some of which are similar to that produced by x-radiation, no definite mutagenic action on irradiated jute, cotton and oilseeds has yet been observed.

Microbiology: A group of fungi and bacteria which can ret jute and other fibres have been grown on suitable substrates and the enzymes secreted together with bacterial spores have been employed to ret fibrous plants like jute, ramie, flax and coconut. Very satisfactory results on a laboratory scale have been obtained. Trials have also been given in certain jute mills for using the retting substance, termed Hiparol by their discoverers, in the retting of coarse root cuttings. Better quality of fibres have been obtained, as compared to those obtained by the batching process usually employed, but its economic feasibility has yet to be established.

Soil Microbiology: A systematic survey is being made on the occurrence of antibiotic producer organisms (fungi and actinomycetes) in soils collected from different parts of Bengal and adjoining States. Five potent strains are being studied, one of these, a *Penicillium* has high potency against both gram positive and gram negative organisms. It is being irradiated by x-rays and ultraviolet rays to find out whether a more potent mutant can be evolved.

Physics: Systematic cosmic ray investigations have been carried out both in Calcutta and in Darjeeling. These include the study of east and west asymmetry of cosmic rays in Darjeeling, determination of the density of neutron in cosmic rays at Calcutta and Darjeeling. The mass of μ mesons has been determined by a study of the characteristics of their tracks on photographic plates exposed at elevation of 12,000 to 14,000 ft. The method worked out for this purpose has been adopted with modification for the determination of the masses of heavy (pi) and light (μ) mesons since 1947. By absorption measurements it was established that protons and neutrons are mainly responsible for meson production.

Continuous record of cosmic ray intensity by means of pressure ionization chamber, and the correlation of its variation with solar and geomagnetic data has been going on for the last three years.

Nuclear interaction with the hard component of the cosmic rays in producing penetrating and mixed showers in lead has been studied in a counter controlled Wilson Chamber. The occurrence of second and third maxima in Rossi's curve under different lead thicknesses has also been studied.

Nuclear Physics: Spontaneous fission of uranium nuclei was discovered independently during the war years, and its half life determined. The amount of plutonium present in pitchblende from Canada has been determined.

The absorption cross section of uranium nucleus for slow neutrons has been determined.

Indian Statistical Institute

The Indian Statistical Institute was founded on December 17, 1931 when it was registered under the Indian Societies Registration Act No. XXI of 1860 as a non-profit society with local branches at Poona, Bombay and Mysore. The Institute combines in one organization a scientific society, a centre for advanced training and researches in statistics, and a fact finding agency using the technique of sampling methods on a large scale.

The work of the Institute in the matter of popularizing the study of statistics among students and businessmen in India has been progressively helped by the activities of the different local branches. The holding of professional examinations in statistics and Indian statistical conferences, training of statisticians and officers on deputation from different State Governments, publishing the statistical journal *Sankhya*, are some of the activities which have an all India basis.

Some of the important projects conducted by the Institute in the past are being mentioned—a five year scheme for improving the jute forecasts in Bengal which was completed in 1941 and followed by annual full scale provincial sample surveys of area and yield rate of jute, paddy and other important food crops in Bengal ; a similar crop survey scheme in Bihar ; crop cutting experiments on sugarcane and wheat in two districts of Uttar Pradesh (formally United Provinces) in 1940-42 ; a diet survey in Calcutta in 1939 ; a public preference survey in Calcutta, Jagaddal, and Asansol in 1941-42 ; an enquiry into the budget and living conditions of working class families in certain areas of Bengal and in Nagpur ; a sample survey of the after effects of Bengal famine in 1944, enquiry into the economics and statistics of road development ; a survey of the refugee population in West Bengal in 1948 etc.

Among the current projects special mention may be made of multipurpose national sample survey. The survey has been undertaken at the request of the Government of India. The Gokhale Institute of Politics and Economics, Poona, is also collaborating with the Indian Statistical Institute. The object of the survey is to provide information regarding various aspects of national economy in the rural sector of India, covering a total area of 790 million acres. The immediate purpose is to collect basic material necessary for the computation of national income and for national planning.

Recently an international education centre for statistics has been organized in Calcutta under the joint auspices of the Unesco, the International Statistical Institute and the Indian Statistical Institute. The centre which was formally opened on October 13, 1950 is administered by a joint board of directors representing the International Statistical Institute and the Indian Statistical Institute.

The object of opening the centre is to provide statistical training to persons in the countries of Middle, South, and Far East who will have practical statistical responsibilities in Government, financial, commercial or individual establishments, or in scientific research institutions. A total of eighteen trainees from five different countries participated in the first semester work (October, 1950 to April, 1951). In the second term which commenced in July, 1951 and will last for six months thirtysix trainees from ten different countries are participating.

In research, the Institute has to its credit a considerable volume of work both in theory and applications of statistics. Total number of papers published and reports submitted by the workers of the Institute come to about 520. A brief description of some of the important studies in theoretical statistics is being given in what follows.

Problems relating to general divergence between two or more groups have been the subject of research by the workers of the Institute for a long time. Researches in this direction were initiated by P. C. Mahalanobis about 25 years ago in connection with statistical analysis of anthropometric measurements. It was the starting point of a good deal of mathematical research in the theory of sampling from multivariate correlated population by R. C. Bose, S. N. Ray, A. Bhattacharya, C. R. Rao and others. To indicate briefly the nature of the work some of the results obtained by the workers of the Institute are being mentioned below. The concept of a measure of divergence between two populations was developed and an appropriate mathematical form was devised for classification of groups in terms of the mean values of the variates in respect of which different groups are studied. This came to be known as classical D^2—statistic.

The classical D^2-statistic involved certain approximations. These restrictions were later removed and a suitable function was constructed involving only the group characteristic of the sample. The proper technique for using this function in the problem of classification and discrimination was also developed. New problems in this field continually arise and are engaging the attention of the workers of the Institute.

At one time a great deal of work relating to the design of agricultural experiments had been done in the Institute. This had led to significant theoretical research in which the concepts of Galois field and finite geometry were used with great success. To mention a few only, a general theory of the construction of balanced incomplete block designs was developed ; a class of designs known as partially balanced incomplete block designs including the balanced incomplete block designs and quasi factorial designs as special cases, were discovered ; considerable progress was made towards the solution of the problem of confounding in the general factorial design ; the problem of confounding of interactions in asymmetrical factorial experiments was successfully tackled and methods of construction of balanced designs were investigated.

Different statistical projects conducted by the Institute also raised many questions of theoretical interest. A good many papers issued from the Institute have originated in this way. In most cases these have definite practical ends in view. The important point to be noted is that it has always been the policy of the Institute to emphasize the fact that statistics is an applied science and that its ultimate justification lies in the promotion of human welfare. The workers of the Institute fully realize the importance of fundamental research, but their aim is to develop the mathematical theory in actual relation to practical problems. The research work in the Institute has been more or less developed in conformity with this principle.

Institute of Nuclear Physics

History: The Institute has grown out of the physics laboratory of the present incumbent of the Palit Chair of Physics, Prof. M. N. Saha, and is located on a plot of land acquired to the south of the site of 92, Upper Circular Road. The beginning dates back to 1940 when, with a donation of Rs. 60,000 from the Dorab Tata Trust, the component parts of a 38″ Cyclotron were purchased from the U.S.A. This machine has since its purchase been redesigned and fitted with improved equipments. Dr. B. D. Nag Choudhury who had worked in Prof. Lawrence's Laboratory, is in charge of the assembly of the machine.

The original small room constructed at a cost of Rs. 30,000 to house the cyclotron now forms a wing of the recently erected three storied Nuclear Physics Institute, whose foundation was laid in April, 1948 and was opened by Mme. Irène Curie in January 1950. The total floor space of the building is over 30,000 sq. ft. and the cost of erection came to Rs. 6.40 lakhs, of which the sum of Rs. 2.0 lakhs was contributed by the Calcutta University and the balance by the Central Government. The total expenditure incurred so far, both capital and recurring, has come up to about Rs. 10 lakhs, part of which have been met from donations from private benefactors like T.C. Sur Endowment, Rs. 2 lakhs; Birla Bros., Rs. 60,000; Rai Bahadur R. P. Saha, Rs. 45,000; and Dr. B. C. Law, Rs. 17,500. The Institute is now receiving a maintenance grant from the Central Government.

The administration of the Institute is in the hands of a Governing Body of which the Vice-Chancellor of the Calcutta University is *ex-officio* Chairman, with eight members including two representatives of the Calcutta University, the Director, one representative each from the Ministry of Natural Resources and Scientific Research, Ministry of Education, Atomic Energy Commission, the Inter Universities Board, and the Accountant General, West Bengal.

Teaching and Research: The Institute consists of the nuclear physics and biophysics laboratories and a teaching laboratory for M.Sc. students. There is a workshop and a library which is being organized at present. The staff consisting of sixteen research workers and twenty other members include administrative, workshop and lower grade employees.

The research laboratories of the Institute of Nuclear Physics include such equipments as a cyclotron, β— and γ- -spectrographs, scintillation counters, proportional counters, delayed coincidence and coincidence analyzers, cloud chambers and pulse height analyzers and a mass spectroscope in the making. It further plans to build up a radiochemical laboratory whose need is badly felt and for which funds have recently been sanctioned. A section of the laboratory is devoted to vacuum technology and to instrument designing and construction. The biophysical laboratory under N. Das Gupta, includes an electron microscope and one gramme of radium. The teaching laboratory has among its equipments, counters, cloud chamber, ionization chamber and electrometer etc.

The Institute at present undertakes both teaching and research. Teaching and laboratory training is given to M.Sc. students and post-M.Sc. students of the Calcutta University. Investigations are being carried out in theoretical physics, β— and γ—ray spectrometry and their angular correlation, determination of short-lived metastable states, conversion co-efficients, problems of high vacuum characteristics of ion plasma discharge, cloud chamber study of fission tracks, ionospheric applications etc.

2. MEDICAL

Medical Education and Research

Brief History of Medical Education

AS far back as 1707 Calcutta could boast of a hospital, the General Hospital, established by the foreign settlers for the treatment of Europeans. The subsequent wars with the Nawabs of Bengal brought in their wake an influx of a large number of sepoys, and it was found necessary to have a separate 'Hospital for Sepoys' in 1760. A temporary hospital was built at Kidderpore in 1762 pending the erection of a new hospital building in Fort William. The large plot of land occupied by the Presidency General Hospital was purchased by the Government in 1768 and the hospital was built a few years later. It was also meant exclusively for the Europeans. The first hospital for the 'native' population of Calcutta was opened at Gurunhatta in 1793. The fund was raised by public subscription and the governing body consisted of an equal number of Indian and European members. The hospital was shifted to a more commodious building in Dhurrumtollah in 1796. It continued there until 1871 when a fresh proposal was made for raising more funds with a view to removing it to a better and more spacious site on the banks of the Ganges. The Mayo Memorial Fund contributed Rs. 50,000 and the new hospital, since called the Mayo Hospital, was opened on September 5, 1874.

The history of medical education in India is but another example of a very well laid plan that used to determine the administrative policy in the early part of the nineteenth century. The British in those days never contemplated of imparting the same kind of medical education as was then prevalent in their own country to enable the Indians to call themselves doctors. The beginning was, therefore, a very modest one. The first opportunities that came in their way were to train themselves up in the art of compounding and dressing. Once in the track, nothing could stop them from acquiring more and more knowledge of the Western medical science, and gradually they learnt the art of diagnosis and treatment of diseases. The administration which was very short of medical personnel in those days decided to appoint these men after an examination in subordinate positions in the regimental and civil hospitals.

The first attempt to establish an institution where the people of the country could get a systematic teaching in medicine was made in 1822. On May 9, of that year the Medical Board addressed a letter to the Secretary to the Government of India in the Military Department on the 'want of native doctors for the supply of the various departments with the civil and military branches of the service' and submitted a memorandum on 'the only plan likely in their judgment to remove the embarassments thence arising'. The Board's memorandum stressed that 'owing to the abolition of general hospitals in which native doctors used to receive a good practical training, the recent extension of British territory and the increase of the native army, it had become almost impossible to obtain suitable men for the duties required of them'.

A proposal was, therefore, forwarded for establishment of a regular medical school in the Presidency. Provision was made for stipends to the students during the years of their study on condition that they on qualifying agreed to serve the Government for a stipulated period. For their practical training arrangement was done for posting them in different hospitals then existing in the city—the General Hospital, the King's Hospital, the Native Hospital and the Company's Dispensary. The proposal was accepted by the Government in their Military Department letter No. 362 dated May 24, 1822. The final scheme as adopted was published as a General Order on the June 21, 1822. The first batch of students numbering twenty were admitted in January, 1823. On June 10, of the same year a sum of Rs. 710 was sanctioned for the purchase of two skeletons which were obtained through Messrs. Bathgate & Co. The instructions were given in vernacular, both Sanskrit and Urdu. The Sanskrit classes were located in the Sanskrit College and the Urdu classes in the Calcutta Madrassa.

The annual report of the School for 1825 reads as follows :

> "The zeal and diligence with which the pupils prosecute their studies even in the least attainable part, i.e., Anatomy, afford a very cheering prospect of their ultimately becoming one of the most useful class of servants in the service of the British Government of India."
>
> "In such an extensive empire as this (India), which probably contains nearly a hundred million of soul, the utility of a native institution with reference to humanity alone in the present lamentable state of ignorance in the generality of the native medical men of Hindusthan, can not for a moment be questioned and it may be confidently stated that the fairest prospect is now opened of every expectation of Government being in progress of time realized by its establishment at this Presidency".

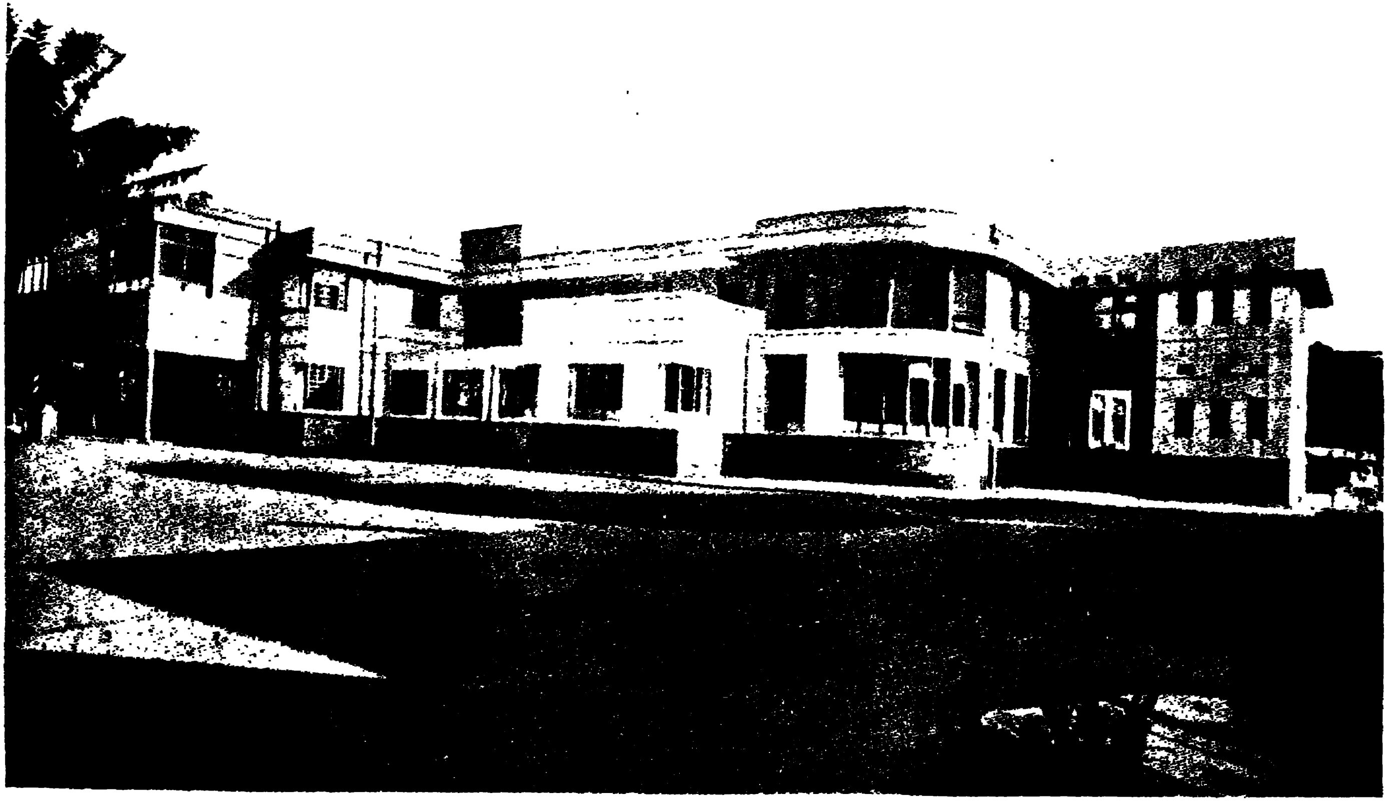
In 1833, Lord William Bentinck, the then Governor-General set up a Committee to deal with the whole question of medical education in India. This Committee consisting of six members, including an Indian Babu Ram Comul Sen, submitted its report on October 20, 1834, recommending among various other measures a change of the medium of instruction from vernacular to English. The recommendations were accepted by the Governor-General in Council and a Government Order was issued on January 28, 1835 decreeing that a new medical college be established for imparting a higher standard of education to Indian youths in the western medical science. The Calcutta Medical College came into existence on February 20, 1835. Ever since then the progress and spread of the western medical science in the country is intimately bound up with the history of this premier institution in the East. Epoch making discoveries and developments during the last hundred years have revolutionized the whole conception of medicine. It is impossible today to imagine a world without anaesthetics, x-ray or aseptic surgery. But that is what it was—anaesthetics were unknown and aseptic surgery was inconceiveable until the latter part of the nineteenth century. The existence of x-rays came to be known much later. Death rate was naturally high in the pre-antiseptic days. Open operations were never done until 1883. Of the ten abdominal operations done in 1884, six succumbed. 'Hospitalism' was a frequent cause of death. Dr. Kenneth McLeod, Professor of Surgery in the Medical College (1880-83), was the first person to practise 'listerism' in this country. Although much denounced by his colleagues he asserted that healing of wounds was possible by first intention. Controversy gradually came to an end and aseptic surgery established itself by the year 1885.

Impetus to post-graduate teaching and research work in tropical diseases was given by the establishment of the Calcutta School of Tropical Medicine in 1922. The All-India Institute of Hygiene came into existence ten years later in 1932. Earlier in this century, the R. G. Kar Medical School which was a standing monument to the memory of late Dr. Radhagobindo Kar, one of that small band of pioneer workers who dedicated their lives for spread of medical education in this country, was upgraded as a college, the Carmichael Medical college, since re-named as the R. G. Kar Medical College. Two other colleges have been added to the list both in 1949. The good old Campbell Medical School becomes the Nilratan Sarkar Medical College and the two private medical schools, the National Medical Institute and the Calcutta Medical School, combine together to form the nucleus of the other new Medical College. There are thus four medical colleges in this city. Besides there is the Lake Medical College which began its career in 1947 mainly for the training of the army licentiates; but it has already started closing down by stages which will be complete by the middle of this year.

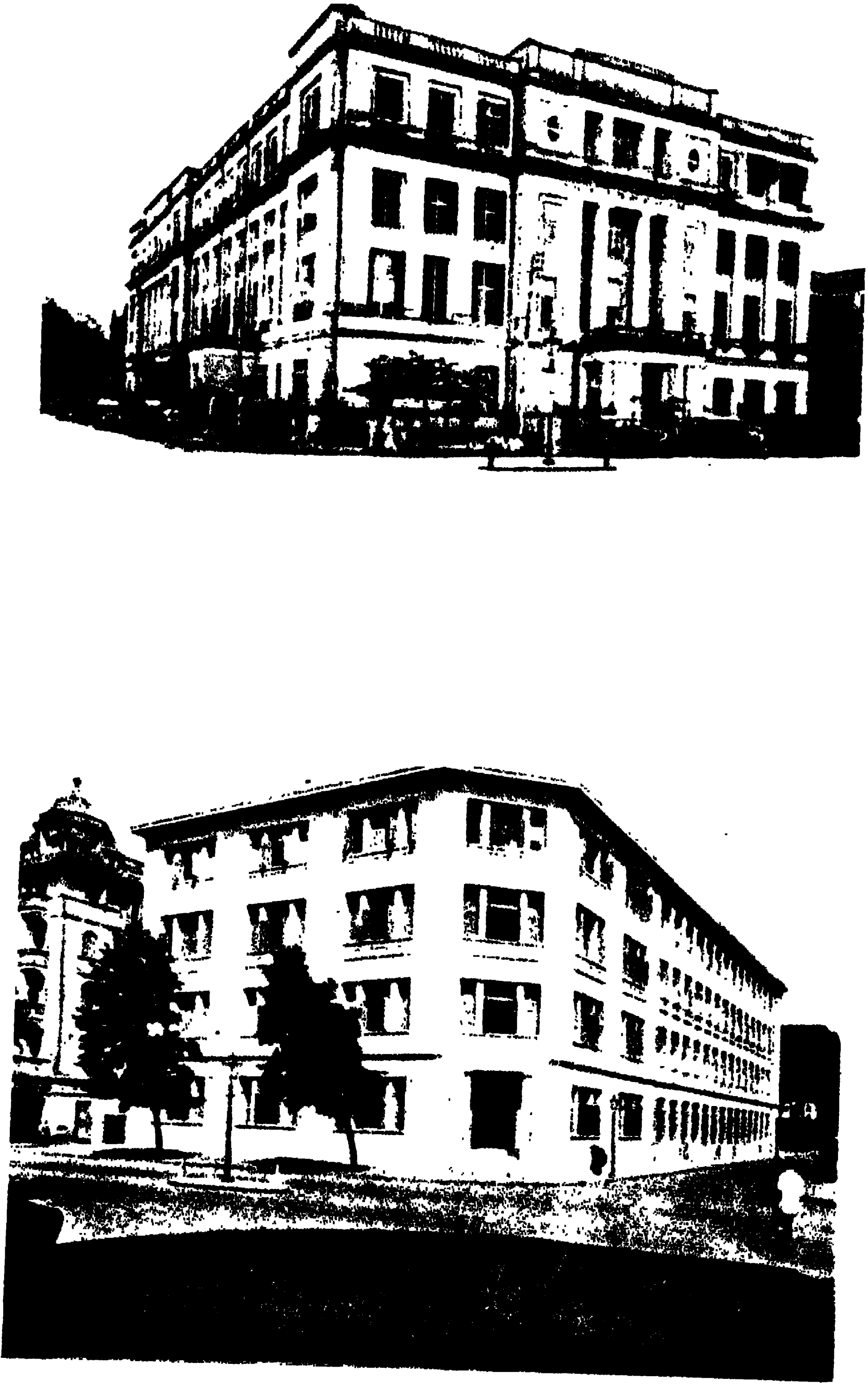
Medical Researches

Ever since the days of the East India Company medical and public health problems of this country have formed the subject for study of members of the medical profession working in Calcutta. During the early part of the nineteenth century, workers in the medical service of the Company studied the clinical features and post mortem appearances of various fevers and dysenteries and intestinal fluxes that infested this country and tried to recognize the different clinical entities and work out some form of treatment. Bacteriology and parasitology was then practically unborn and theories on the causation of diseases were generally handicapped by medievalism. Yet the clinical description of various ailments were so lucid that it was easy to recognize from their writings the existence of many of the diseases such as enteric, malaria, dengue, kala-azar, cholera, dysentery (a type called hepatic dysentery was apparently amoebic dysentery), naga sore, heat stroke etc. Climate of the country and the diseases occuring in different seasons were also studied. Annesley (1828), Twining (1832), Fayrer (1882), and Martin (1841) were some of the clinicians and the first named was apparently one of the earliest to record and admirably illustrate various pathological changes noted post mortem in various disease conditions. From the coloured lithographs produced by Annesley, it is easy to recognize specimens of amoebic liver abscess, amoebic dysentery, bacillary dysentery, cirrhosis of the liver etc. Clinicians working at the Medical College, and at other hospitals were responsible for many publications on the various diseases prevalent in this country.

With the development of the sciences of bacteriology and parasitology, scientific researches were initiated by various workers about the last two decades of the nineteenth century. These workers often had to carry on their investigations under difficult circumstances handicapped by lack of equipment, official callousness and at times interference. Yet outstanding contributions were made by more than one worker. In 1885, Cunningham first saw the parasite of oriental sore, in 1898, Ross discovered the mode of development of the malaria parasite in the mosquito and described the probable mode of transmission of human malaria. A gate and a small statue at the Presidency General Hospital commemorate the great discovery of this pioneer worker. Indian workers mainly contributed clinical studies of the diseases, and B. C. Sen (1887) first described the clinical features of infantile hepatic cirrhosis and N. R. Sarkar (1894) made valuable contributions to this subject.



MEDICAL COLLEGE, SIR JOHN ANDERSON EMERGENCY WARD



ALL-INDIA INSTITUTE OF HYGIENE AND PUBLIC HEALTH

During the early years of the present century, medical researches were carried out in Calcutta in different medical institutions and hospitals, and some of the contributions, specially in tropical diseases, were of outstanding importance. To mention a few, Rogers was the first to culture leishmania in artificial medium; he introduced emetine treatment of amoebic liver abscess; he showed that the "tropical liver abscess" was a sequel of amoebic dysentry and was due to the amoebic infection. Treatment of cholera with hypertonic saline, of leprosy with hydnocarpus oil and its derivatives, of kala-azar with antimonyl tartrates were some of the well known and important advances made by Rogers besides a vast amount of epidemiological, clinical, and pathological work on various tropical diseases. Of the Indian workers, mention may be made of the important work of intestinal flagellates and leishmania. G. C. Chatterji, a co-worker of Rogers, and Brahmachari carried out 'studies on haemolysis', McCay on metabolism and nutrition in Indians and C. B. Ray on various bio-chemical subjects.

Important chemotherapeutic research on kala-azar was conducted during World War I by U. N. Brahmachari, and this culminated in the synthesis in 1922 of urea stibamine recognized the world over as one of the most powerful anti-kala-azar drugs. Brahmachari was also the first to describe the peculiar sequel of kala-azar that he named 'dermal leishmanoid'.

The School of Tropical Medicine, Calcutta, was established in 1921 to provide for an well equipped and staffed institution where researches could be undertaken on the various diseases prevalent in this country. Before the establishment of the School, researches were carried out at the various teaching and general hospitals where lack of equipment and trained personnel and official difficulties often handicapped the efforts of average workers. That outstanding researches could be carried out by a Rogers or a Brahmachari under such circumstances speak only of the individual greatness of such workers. Of the researches that have been carried out in Calcutta during the last thirty years, the vast majority has been from the School of Tropical Medicine and from the more recently established All-India Institute of Hygiene and Public Health. But important contributions have also been made from the older teaching colleges, *viz.*, the Medical College, and other research institutions, *viz.*, the Indian Institute of Medical Research, the Bengal Immunity Research Laboratories etc. The research work carried out has been mainly on medicine and its allied subjects and the emphasis has naturally been on tropical diseases.

In surgery, important contributions were made by K. K. Chatterjee and F. P. Connor on the surgical treatment of filariasis, and the former carried out considerable amount of pioneer work on venereology. In obstetrics, the monumental work on the obstetric forceps and the development of the 'Bengal forceps' by K. N. Das and, in gynecology, S. Mitra's operation for carcinoma of the uterus are well known.

A brief resume of the outstanding or very important researches carried out during the last quarter of a century in Calcutta is given in what follows:

***Malaria*:** The simian parasite *Plasmodium knowlesi* that produces a virulent infection in the rhesus monkey comparable to malignant tertian malarial infection in man was discovered. This parasite has been used all over the world for carrying out various investigations on malaria. The treatment of malaria has been standardized and a successful, easy and cheap method of chemoprophylaxis of malaria in highly endemic areas in Bengal, has been worked out.

Kala-azar: Work in this disease includes incrimination of the sand-fly *Phlebotomus argentipes*, as the vector of kala-azar, introduction of all the diagnostic serum tests, important contributions to pathology, and standardization of treatment of the disease with various chemotherapeutic agents.

Typhus fever: Researches on typhus fever have led to the recognition that endemic typhus fever occurs in India, work on actual experimental transmission of endemic typhus by the mite *Trombicula deliensis* has shown that a fair proportion of *Rattus rattus* were infected with *Rickettsia orientalis*, the causative organism of endemic typhus, and that larval mites parasitic on these rats were infected and transmitted the infection to four generations of mites.

Epidemic dropsy: Experimental production of epidemic dropsy in human volunteers by ingestion of mustard oil adulterated with oil from *argemone mexicana* seeds has proved the theory put forward previously by the late Soroshi Lal Sarkar that contamination of mustard oil with argemone mexicana oil was responsible for epidemic dropsy. Experimental production of epidemic dropsy in the rhesus monkey has thus opened out the field for experimental work on the disease, various tests for contamination of mustard oil with argemone mexicana oil have been worked out.

Dysentery: As early as 1928, Acton and Knowles pointed out the importance of treating secondary infection of the bowel in cases of amoebiasis and indicated that entamoeba histolytica could occur as a commensal. Both these facts are well recognized now by workers in all parts of the world.

Cholera: Considerable amount of epidemiological, biochemical and chemotherapeutic investigations have been carried out, and value and limitations of various therapeutic agents, *viz.*, bacteriophage, sulphonamides, antibiotics, worked out.

Leprosy: First description of the adult form of *W. malayi*, determination of the life span of microfilaria, evolution of the theory of pathogenesis of filariasis, chemotherapy and showing that antimonials and vaccines from secondary invading organisms are useful in relieving the symptoms of filariasis, are some of the important investigations carried out in this field.

Research on Indigenous Drugs: Chemical and pharmacological researches on indigenous drugs have made notable progress. A complete list of medicinal plants has been compiled. Of the drugs that have proved to be of value, mention may be made of rauwolfia serpentina, daemia extensa, vitax peduncularis, butea frondosa, punarnava, plantago ovata, oil of bouchi etc.

Haematology: Investigations on anaemia in pregnancy and the evolution of a hypothesis on the causation of tropical macrocytic anaemia may be mentioned in this field.

The above resume is far from complete, and only well known contributions made from Calcutta are mentioned. With the establishment of newer research laboratories, the expansion of the existing ones and the upgrading of several medical institutions to the status of a full fledged college which will necessarily be associated with improved facilities for research, there is every reason to hope that the high tradition of medical research in Calcutta will be maintained and that valuable contributions will continue to be made to the cause of alleviation of human suffering and preventive medicine.

A brief account will now be given of some of the important medical colleges and institutions of Calcutta.

Medical College, Calcutta

The circumstances leading to the establishment of the Calcutta Medical College has been referred to more than once. The College was opened on February 20, 1835 and was first accommodated in the premises previously occupied by the Petty-Court Jail, an old house at the back of the then Hindu College. The first Superintendent was Dr. M. J. Bramley and Dr. H. H. Goodeve was appointed his only assistant. The Superintendent with the aid of his assistant was expected to instruct the pupils in anatomy, surgery, medicine and pharmacy. There was then no library, no museum, no hospital and no "philosophical" apparatus as they were then called. Anatomical preparations were soon obtained from England through Messrs. Bathgate & Co. and one Mr. Evans was appointed to organize the museum. There was a deep rooted prejudice at that time against the study of anatomy or dissection of human body and it was no mean courage for Pundit Madhusudan Gupta to prove the courage of his conviction by dissecting a human body with his own hands on January 10, 1836. It is said that guns were fired from the rampart of Fort William to commemorate this great event in the history of medical education in this country.

The first hospital with an accommodation for 20 patients was opened on April 1, 1838. The final examination of the first batch of students was held on April 30, 1838 after a little over 3 years' study in the College which included, besides the medical subjects proper, such basic sciences as physics., chemistry and botany. This College, therefore, has the unique distinction of being the first medical college in the world where instructions were given in the preliminary sciences as well as in the clinical subjects and all such subjects were included in the qualifying examination. Prior to this even in the medical schools of Europe, the students were allowed to select for the purpose of training and examination either medicine or surgery or midwifery in which they desired to practise. It was some 20 years later that the same principle of an all-round training in the clinical subjects was adopted in the Vienna School of Medicine.

In order to bring medical relief within the reach of the masses it was felt necessary that a secondary course should be started in which the teaching of the medical subjects would be done through the medium of vernaculars. Accordingly, a Hindusthani class was opened in 1838 for the education of subordinate doctors. Majority of the students attending this class hailed from the Central and Northern India who on qualifying were mostly recruited as subordinate medical assistants in the Army. The Bengali class which was intended to train subordinate doctors for the civil hospitals and jails as well as to meet the general scarcity of trained medical practitioners was opened 14 years later in 1852. The Medical College gradually increased in size and importance and the consequent overcrowding resulting therefrom necessitated in 1873 the transfer of the vernacular class to a newly established medical school, the Campbell Medical School, lately upgraded and renamed as the Nilratan Sarkar Medical College.

The year of 1852 is notable for the fact that the magnificent Medical College Hospital building, the oldest building in this compound, was opened for the reception of patients on December 1, of that year.

The Medical College was affiliated to the University of Calcutta in 1857. In 1860, a Code of Rules was drawn up, regulating the courses of study and examinations. The students satisfying these conditions were allowed to appear at the examinations for Licence in Medicine and Surgery (L.M.S.), Bachelor of Medicine (M.B.) and Doctorate of Medicine (M.D.) of the Calcutta University. The L.M.S. course was abolished in 1907 and the course of study was extended to 6 years.

The Medical College is at present a teaching institution for medical students and nurses. The College offers facilities for both undergraduate and post-graduate medical training. The curriculum for the M.B.B.S. Degree consists of (*i*) a pre-clinical course and (*ii*) a clinical course. The pre-clinical course includes such basic subjects as anatomy, physiology, elementary pharmacology and chemistry and the students are required to pass a university examination before they are allowed in the senior course. The clinical course of study includes the major subjects of medical practice—medicine, applied pharmacology and therapeutics, surgery, pathology, midwifery and gynaecology as well as medical jurisprudence and hygiene. The curriculum extends over a period of five years—two years in the pre-clinical course and three years in the clinical. On their passing the final examination they are to undergo training as pre-registration clinical assistants in the hospitals for a period of six months.

Besides there is now a condensed course of two years for the medical school passed candidates. Of these two years the students receive training for six months in the pre-clinical course and for a year and a half in the clinical course. They have to appear at the final examination along with the regular students and must show the same degree of proficiency in the subjects before they are admitted to the Degree of M.B.B.S.

The College also offers facilities for post-graduate training. There are two excellent museums—one in the Anatomy and the other in the Pathology Department—full of rare specimens of great scientific value, of which any medical college can justly feel proud in any part of the world. Arrangements exist for special courses of study and training in different subjects under the respective heads of departments which prepare the students either for specialist practice or for higher university examinations. Research work is done and valuable results have been achieved in various branches of the medical science.

This institution is one of the biggest training centres for nurses in India. The full course is one of three years. The nursing profession once despised by the educated Bengali community is now drawing recruits from middle class families. In fact, it has opened up a new avenue of employment which is not only paying but humane and dignified at the same time.

The plan of development includes among other projects the introduction of a new set-up which will ensure better teaching for the undergraduate and post-graduate students. In this scheme there will be several posts of professors in all major clinical subjects—each a specialist in his own particular branch of medicine, surgery or midwifery. Apart from the question of offering better opportunities to the students under training, the new set-up when it starts functioning which it is expected to do in the near future, will undoubtedly afford better facilities for specialist treatment of patients in the hospital.

R. G. Kar Medical College Hospitals

R. G. Kar Medical College Hospitals, the first non-official medical college in India, was founded in its embryonic condition in the year 1886, under the name of Calcutta School of Medicine. In 1897, an insignificant hospital, with only 14 beds, was established at 298, Upper Circular Road, when the total number of students was 520. In 1898, a plot of land was purchased at Belgatchia, the present site of the Institution, and the one storeyed Albert Victor Hospital was opened with only 36 beds, at a cost of Rs. 70,000.

The bequest of Sri Bolye Chand Dey, amounting to Rs. 37,000 enabled the acquisition of a plot of land towards the then eastern boundary of the Hospitals and the one-storeyed Infectious Diseases Hospital was erected there. A second storey was added in 1925. The Nirmalendu Tuberculosis Sanatorium, the third storey of the same building, was built by the magnificent donation of Rs. 1,60,000/- of Late Rai Jnan Chandra Ghosh Bahadur and Rs. 14,000 of the Dr. Bepin Behari Ghosh Memorial Committee. A scheme has been prepared to build a new Infectious Ward on the adjoining land of the College.

The foundation of the Surgical Hospitals was led by Lord Ronaldshay in 1921. The Taraknath Ganguli Block was opened with the handsome endowment of Late Dr. Lal Behari Ganguli. The Sir Kedarnath Das Maternity, one of the finest buildings in the Hospitals, was constructed in 1935, The Bissumbhar Dutt Children Ward of 10 beds was opened in 1932.

The Outdoor Departments are catering to the needs of 3 lakhs of patients per year as estimated in 1947, compared to 14,000 in 1916. At present there are Surgical, Gynæcological, Ante-Natal, Dental, Ophthalmological, E.N.T., Orthopaedics, Chest, Psychological, Neurological, Radium and Electrological and Emergency cases out-patients' Departments. The Orthopaedics Department started functioning last year and the Emergency Department has been reconditioned.

The Radiological Department as also the radium annexe opened by the munificence of Messrs. Benoy Bhusan Gupta and Indu Bhusan Gupta are situated on the ground floor of the New Maternity Building and is named the "Nalini Gupta Radium Annexe."

The College Departments were simultaneously improved and larger lecture theatres and well equipped laboratories have been provided in the present three-storeyed building.

The New Anatomical Block, a separate building, was constructed in the year 1926. Arrangements for the preservation of Cadavars have been made in this Department by maintaining a cold-storage chamber.

There has been a steady development in hospital accommodation along with expansion of the different wards. In 1918, the number of beds was 112, which rose to 320 in 1926, 360 in 1934, 531 in 1942 and to 557 in the present year. Further addition of beds in different departments is expected shortly. All through its existence, the hospital has rendered its best service to the people of Calcutta. The daily attendance at the hospitals has now been practically doubled. The daily average attendance in the Out-patients' Departments is now registered at over 1000.

The total number of students in 1916 was only 60, which came up to 607 in 1926, 699 in 1936, 876 in 1946, 1000 in 1947 and about 1500 today. Since 1921, over 2500 doctors have been produced by this institution.

Calcutta Medical Institute

The College of Physicians and Surgeons of India and the National Medical College of India, with its attached Hospital known as the Calcutta Free Hospital, were founded by the late Dr. S. K. Mullick M.S., M.D., at 301/3, Upper Circular Road, Calcutta. The land was obtained on 99 years lease from the Corporation of Calcutta and a modest building erected with public donations. The Government did not recognize these non-official medical institutions, which for some time retarded their growth. The Bengal Council of Medical Registration could not recognize the diplomas granted by these institutions. In the interest of the large number of students who had spent considerable amount of money and time in these private institutions, the name of the National Medical College of India was changed as the Calcutta Medical School. It was reorganized for obtaining State recognition.

In 1923, a Society called the Calcutta Medical Institute was incorporated and registered under Act XXI of 1860. The societies called the National Medical College of India and the King's Hospital were dissolved and all their assets and liabilities made over to the Calcutta Medical Institute on May 8, 1923. Students of the former institutions as well as a large number of new candidates at once got their admission into the Calcuta Medical School which, after repeated inspections by the Bengal Council of Medical Registration, was the first in India to receive temporary affiliation only for two years to teach students for the primary and intermediate examinations. On the results of these examinations, further affiliation was obtained by this School to train students up to the final examination of the State Medical Faculty. Admissions into the School were limited to 100 students a year.

With generous donations from the public the authorities of this Institute were soon able to erect a big 4-storied building of the modern type for the hospital to accommodate in all 170 beds with 3 up-to-date surgical and gynæcological operation theatres and also two out-patient's department with a daily attendance of nearly 400 out-door patients. A big anatomy block was constructed and several contiguous properties were also acquired.

The Institute received a capital grant of Rs. 50,000 from the Government of West Bengal and of Rs. 1,50,000 from the Corporation of Calcutta. Besides it receives annually a recurring grant of Rs. 20,000 from the Government and Rs. 30,000 from the Corporation of Calcutta. There are endowments of a fairly large amount.

In 1948, this Institute and the National Medical Institute of 32, Gorachand Road were amalgamated and a new society called the Calcutta National Medical Institute was formed and registered under Act XXI of 1860. It has established a college affiliated to the Calcutta University up to the M.B.B.S. standard.

School of Tropical Medicine

History of its foundation: As long age as 1910, Leonard Rogers stressed the importance of establishing a school of tropical medicine in Calcutta for carrying out investigations on the various diseases that are prevalent in this country and to utilize the vast wealth of clinical material for the purpose of researches on, and teaching of, tropical medicine. For the next ten years he strove with infinite perseverance against administrative difficulties to obtain sanction for his scheme, acquire space, plan the buildings, raise funds and arrange for staffing the School. When in 1920, this dream had come true and the School was a reality and the Hospital for Tropical Diseases built at the cost of Rs. 3¼ lakhs, Rogers went on leave to England preparatory to retirement. Knowles who succeeded as the Secretary carried on the work of building up and putting the School on a sound financial position. Capital expenses of the whole scheme were shared by the Government of India (32%), the Government of Bengal (31%), the Endowment Fund of the School (24%) and the Indian Research Fund Association (13%). The Government of Bengal came forward to finance the running expenses of the hospital and most of the expenses of the School, the rest being borne mainly by the Endowment Fund and partly by the Indian Research Fund Association. The Endowment Fund of the School that played so large a part in building up and carrying on the research activities of the School was raised entirely by public donations from the business communities of Calcutta and various industries, representing tea, jute, mining, etc., the Corporation of Calcutta and the railways. All these organizations provided for recurring grants.

The working of the School commenced in 1921 and the first batch of students appeared for the D.T.M. in 1922. The School of Tropical Medicine, Calcutta, originally called Calcutta School of Tropical Medicine and Hygiene, was officially opened on February 4, 1922. Lt.-Col. J. W. D. Megaw. was the first Director, Sir Ram Nath Chopra was the first Indian Director, and Dr. R. N. Chaudhuri is the present Director of the School.

Since May, 1949 the management of the School has been vested in a governing body composed of nineteen official and non-official members with Dr. K. C. K. E. Raja, Director-General of Health Services, Government of India and Dr. B. C. Das Gupta, Director of Health Services, Government of West Bengal as President and Vice-President respectively.

The institution consists of (1) the School Departments; (2) the Carmichael Hospital for Tropical Diseases and (3) Out-patient's Departments.

The activities of the School have expanded rapidly till at the present time there are nearly 20 departments, each busily engaged in the conduct of research in addition to routine hospital and teaching works.

Important Research Work carried out since inception : The research work undertaken covers tropical medicine, pharmacology, entomology, chemistry, pathology and bacteriology, protozoology, hæmatology, diabetes, filariasis, helminthology, dermatology, kala-azar, leprosy, bowel diseases, indigenous drugs etc. Some of the achievements of the School are given below:—

(1) Discovery of *Plasmodium Knowlesi* that produces virulent malaria in the rhesus monkey and is transmissible to man. This parasite has been extensively utilized in India and abroad for chemotherapeutic and immunological studies;

(2) Isolation of the causative agent of human leptospirosis for the first time in India and demostration of wide distribution of Weil's disease in this country;

(3) The pioneer researches on the skin diseases have resulted in recognition and systematization of various skin diseases seen in India, the features of which often vary from those in the western countries. Vast amount of statistics, clinical data, photographs, coloured drawings, numerous strains of pathogenic fungi have been collected and new methods of investigation and cultivation of fungi developed, new strains of organisms isolated and new methods of treatment of several skin diseases introduced;

(4) Incrimination of the sandfly, *Phlebotomus argentipes*, as the insect vector of kala-azar;

(5) Standardization of the treatment of malaria with quinine, cinchona febrifuge, atebrin, plasmoquine, etc.;

(6) Recognition of typhus not carried by the louse;

(7) Chemical and pharmacological researches on indigenous drugs and the compilation of a complete list of medicinal plants. Mention may be made of some of the drugs that proved to be of value, *viz.*, rauwolfia serpentina, dæmia extensa, vitex peduncularis, butea frondosa, punarnava, plantago ovata, oil of bouchi, etc.;

(8) Standardization of the diagnosis and treatment of kala-azar (aldehyde test, antimony test, complement fixation test, sternal puncture and spleen puncture);

(9) Introduction of a new D.E.C. medium for culture of dysentery, enteric and cholera organisms;

(10) Study of the normal blood picture in Indians and anæmias prevalent in this country. Important contributions were made on the aetiology and treatment of anæmias of pregnancy, tropical macrocytic anæmia, hook worm anæmia, and aæmias associated with infections. Proper assessment of hæmatinics including liver extracts of Indian manufacture, and therapy of various blood diseases were the other subjects investigated;

(11) Investigation of starvation cases and treatment;

(12) Study on Rh distribution in Indians;

(13) Introduction of carbon tetrachloride treatment for tape worms and standardization of mass treatment of helminthic infection of Indian populations with tetrachlorethylene;

(14) Extensive studies on dysenteries and recognition for the first time of the importance of treating secondary infections in amoebiasis which had now been accepted by all workers outside India. Various sequelae of dysentery, *viz.*, metadysenteric condition, sprue-like condition, ulcerative colitis, etc. were described and the varied clinical, pathological and bacteriological features of putrefactive diarrhoeas described;

(15) Cholera received the attention of the workers almost since the inception of the School. Considerable bacteriological work was carried out and the uses and limitations of bacteriophage in the prevention and treatment investigated. Therapy of cholera with hypertonic saline introduced by Rogers was sought to be improved with the addition of various chemotherapeutic agents, *viz.*, sulphonamides, and bacteriophage;

(16) First description of the adult form of the parasite *W. malayi*, determination of the span of life of microfilaria, evolution of the theory of pathogenesis of filarial infection, were some of the contributions of outstanding importance. The value of vaccine therapy and antimony compounds for the relief of clinical symptoms of filariasis was demonstrated. Guinea worm infection was also similarly investigated and its epidemiology and the intermediate host in different areas studied;

(17) Leprosy researches included an extensive survey, clinical pathological and therapeutic investigations. Some of the pioneer work on the ethyl esters of hydnocarpus oil was carried out in the School and the treatment of leprosy with chaulmoogra oil was standardized. Exhaustive histopathological studies and improvement of the lepromin test are other important contributions to leprosy and these have been of great value in the classification, prognosis and treatment of the disease;

(18) Epidemic dropsy, a disease that is of considerable importance to the people of eastern India, was investigated during the many epidemics that have occurred during the last three decades, and important clinical and pathological work carried out. The work on the experimental production of epidemic dropsy

in human volunteers by Lal *et al* was carried out in close collaboration with the workers of the School;

(19) Diabetes mellitus is a disease fairly common in India. Considerable clinical, biochemical and therapeutic investigations were carried out in human cases and experimental work in animals in which diabetes had been induced by pancreatectomy or by alloxan; and

(20) A great deal of work was done on rat-bite fever, and marked improvements were made in the methods of investigation.

Present activities : (a) Teaching. Ever since 1921 the School has provided for specialized studies in tropical diseases for the D.T.M. mainly for medical graduates and L.T.M. for medical licentiates. Students are drawn from various states of India and from different countries of Asia and occasionally from the U.S.A. and Europe. The School also provides facilities for specialized training in different branches of medical practice and for researches for higher post-graduate degrees.

(b) Medical relief : The hospital for tropical diseases and the various out-patients' departments and clinics provide for investigation and treatment of various tropical diseases. The attendance at the out-patients' departments is heavy and provides clinical material for teaching and research. The large number of cases that are admitted into the hospital are utilized for similar purposes. Each individual patient admitted receives the closest attention, routine examination, various blood tests, examination of stools for protozoa, bacteria and helminthic parasites, and also special examination as required. Different departments of the School may be interested in a single individual case, and an attempt is made not only to diagnose the disease for which the patient seeks relief but also to ascertain all the pathological conditions present and deal with them *serialim*. It is probably this fact which is responsible for the great popularity of the hospital, which always has a long waiting list for admission.

(c) Medical Research : A brief resume of some of the researches recently undertaken or being continued is given below:

(i) Chemotherapy : Extensive chemotherapeutic investigations on various protozoal, bacterial, helminthic, viral or diseases of unknown aetiology have been in progress for the last few years. Clinical trials with the newer antimalarials, *viz.*, proguanil, chloroquin, camoquin, have enabled the proper dosage suitable for Indian patients to be worked out and their therapeutic efficiency determined. It has been shown that some of these new antimalarials are highly efficient in chemoprophylaxis of malaria even in highly endemic areas. Paludrine-resistant malaria parasites were clearly demonstrated for the first time in India. A new aromatic diamidine compound, hydroxystilbamidine, and an antimony compound methyl antimony gluconate, have been shown to be very effective in the treatment of kala-azar. Investigations on the treatment of dermal leishmanoid with new antimony compounds and on that of resistant kala-azar are in progress. In the treatment of amoebiasis it has been shown that Terramycin has distinct action on the infection but occasional cases have failed to respond to this antibiotic

though earlier American reports had indicated that this drug was effective in 100 per cent of the cases. Treatment of secondary infection with antibiotics and sulphonamides followed by specific treatment of amoebic infection has yielded fairly satisfactory results. In cholera, it has been shown that sulphaguanidine is of little value in eliminating the excretion of vibrios. Terramycin and chloromycetin are highly effective in stopping the excretion of cholera vibrio, but there is little difference in the cure rate between the cases treated with these drugs and saline and the cases treated with saline alone. Cutaneous tuberculosis has been found to be very amenable to streptomycin calciferol therapy. Clinical trials of thiosemicarbazones in leprosy are in progress. The work on these bacterial diseases is being continued. In the treatment of filariasis, hetrazan has been found to be useful only in lowering the microfilaria level in the blood but not to any great extent in the relief of clinical symptoms. Antimonials are more useful in the relief of fever and lymphangitis associated with filariasis. Diamino diphenyl sulphone has also been found to be of value in suppressing filarial fever. Aureomycin has been found to yield very encouraging results in the treatment of eosinophillic lungs and good results have also been recorded in the treatment of an obstinate skin disease, pemphigus vulgaris.

(*ii*) *Clinical researches :* Circulatory changes and alteration of body fluids in cholera, epidemic dropsy and severe infections, studies, in plasma proteins in various tropical diseases, investigations on oedema associated with kala-azar, clinical and histopathological studies on post kala-azar dermal leishmaniasis and in leprosy, are some of the clinical researches undertaken.

(*iii*) *Experimental medicine*: Experimental production of epidemic dropsy in the rhesus monkeys has been an outstanding contribution to the problem and the work is being continued. A new simple test for argemone oil has been evolved. It has been shown that white oil also produces toxic changes in monkeys.

(*iv*) *Haematology :* Folic acid has been shown to be of great value in the treatment of tropical macrocytic anæmia, but with vitamin B_{12} the results have not been uniformly satisfactory in this condition. Hook worm anæmia has been shown to be of dimorphic type. Other investigations were on the value of urethane in the treatment of myeloid leukaemia and effect of intravenous iron therapy in anæmia.

(*v*) *Indigenous drugs*: Isolation of the active principles of various indigenous drugs and the study of their chemical composition are in progress. Injectable preparation daemia extensa of low toxicity has been prepared and stimasterol has been isolated from an indigenous drug Enhydra fluctuans; the yield has been satisfactory.

(*vi*) *Other researches :* In addition to the above various bacteriological, parasitological, haematological and therapeutic investigations are in progress.

It will be apparent even from the above brief account that the international reputation enjoyed by the School as the premier research institute for tropical diseases in the East, has been earned as a result of outstanding contributions made by its many workers during the last three decades. This well organized institution with its vast wealth of clinical material and facilities for research, has since its inception attracted eminent research workers. A generation of medical research workers of India had their training at this School. Many of these workers joined other research institutions or organizations and continued their good work and some of them have earned fame for their valuable researches.

The School continues in its arduous task of specialized teaching, medical relief and above all medical research. In its precincts a new generation of workers is treading the 'difficult path that is keen as the razor's edge', striving to understand the mysteries of human ailments and to work out the measures for their cure. There is little doubt that the high standard of researches at the School will be maintained and important contributions will continue to be made to medical science from this institution.

West Bengal Public Health Laboratory

The Sanitary Commissioner to the Government of Bengal whose designation was changed later to the Director of Public Health had the nucleus of a water and sewage analysis laboratory. This enlarged formed the Bengal Public Health Laboratory in the year 1922 under Major A. D. Stewart, the first Director of the Laboratory. The subsequent Directors have been Dr. R. B. Khambata, Dr. B. B. Brahmachari and Dr. A. K. Sen.

Scope of work of the Laboratory is as follows:

(1) Analysis of food-stuffs (*a*) sent from all over Bengal except Calcutta under the Bengal Food Adulteration Act of 1919, and (*b*) from various other sources;

(2) Analysis of water (*a*) of the municipal water works, (*b*) from various official and private sources, and (*c*) the monthly analysis of the water of the jute mills under the Indian Jute Mills Association taken up under a special arrangement from November, 1926;

(3) The analysis of sewage collected from mills and factories as a check against undesirable river pollution and from a few established municipal sewerage works; and

(4) Bacteriological work in relation to public health.

In the early years the energy of the Laboratory was mainly devoted to the acquiring of data for laying down analytical standards as criteria of purity of food-stuffs. Col. A. D. Stewart also took a prominent part in framing the curriculum and in the teaching of the Diploma in Public Health of the Calcutta University. The enthusiasm for research work of Dr. B. B. Brahmachari was considerable. Although the heavy routine work and the reluctance of the Government to provide adequate staff have been great impediments in taking up elaborate work of this nature, the contributions of the Laboratory in the field of research can be said to have been notable. The work on the relative viscosity of mustard oil, and the development of the specific test of argemone oil can be specially mentioned. With the setting up of the Lumetron fluorescent meter the Laboratory hopes to carry out specialized work with its aid.

Pasteur Institute of Bengal

A Pasteur Institute was first opened in India at Kasauli in 1900. At present there are six Institutes in India and the Pasteur Institute of Bengal is one of them. During the period between 1917 and 1924 residents of Bengal had to go to Shillong Pasteur Institute for treatment which entailed a lot of expenditure, hardship and loss of time. It was subsequently found out that some 70% of the patients treated at Shillong went from Bengal, and even then that quite a large number of animal bite cases could not go there for treatment. To bring anti-rabic treatment within easy reach of the people of Bengal, this Institute was opened in May 1924 by Capt. E. C. R. Fox, at the School of Tropical Medicine, Calcutta. The number of patients attending the Institute gradually went up. Patients had to come to Calcutta for treatment from remote places of Bengal and some from Patna. (Institute at Patna was opened on 1929). To obviate these difficulties and to make the vaccine available to the remotest villagers of Bengal within 24 hours of bite, decentralization of the treatment centre was effected in 1934, and thereby treatment centres were opened in all the district and sub-divisional hospitals all over Bengal and recently in the newly opened thana and union health centres. After partition of Bengal in 1947, the number of patients treated went down to 2,864, but the number is steadily on the rise again.

In 1949, the number of patients treated was 4,636 beside 1,781 advise cases and 1,013 absconders, that is, those who did not complete their course. This year the incidence of cases appears to be much higher.

This Institute supplies vaccine also to the railways over Kharagpur, Sealdah, Gaya, Allahabad, Mogalsarai, Dinapore, Tundla, Moradabad etc.

A course of anti-rabic vaccine is given as a prophylactic measure against hydrophobia in man and rabies in animals. There is no curative treatment for this disease at present. Anti-rabic vaccine is prepared out of inoculated sheep brain matter and is composed of 5% sheep brain suspension which contains the dead fixed rabies, virus in 0.5% carbolic lotion. This treatment reduces the incidence of this disease to a very great extent; about 0.2% of the treated cases develop hydrophobia.

In 1950, the total production at this Institute was 7,82,621 c.c. of 5% anti-rabic vaccine.

Every year four batches of students who come for D.P.H., D.T.M., L.T.M. and laboratory technicians courses get their training in rabiology at this Institute. This Institute is at present located in the School of Tropical Medicine building on Chittaranjan Avenue.

A proposal has already been put up before the Government to establish a State Laboratory in which all the institutes concerned with the manufacture of different types of vaccines used for public health prophylaxis will be housed.

All-India Institute of Hygiene and Public Health

The All-India Institute of Hygiene and Public Health is, perhaps the first fruit, in India, of international co-operation, the importance of which is now being increasingly recognized. Starting in 1933 with a munificent gift from the Rockefeller Foundation of New York, for the building and equipment, it has been carefully nursed by the Government of India and although barely eighteen years old the Institute has already acquired a position among the first ranking public health institutes of the world. It serves two main purposes, namely, (1) to provide post-graduate training in public health and (2) to undertake research for the solution of major public health problems confronting the country with special reference to the social, economic and environmental situations. To better fulfil these two objects, a rural health centre at Singur is attached to the Institute and also collaboration of the various municipal, institutional and industrial organizations in and around Calcutta is being obtained for conducting the teaching and research programmes. The good name that the Institute has built up has attracted the attention of neighbouring countries and of international organizations for the training of public health personnel and as a result international research schemes and training of personnel of neighbouring countries are being undertaken. The experience and special qualifications of the senior staff are being fully utilized for these purposes, and they are receiving international recognition as experts in their respective fields.

Public Health Training: When the Institute was first started, only three courses of training, *viz.*, D.P.H., D.P.H and Hy. and D.M.C.W. were being given; but now there are eleven important courses for the training of public health personnel of various categories, *viz.*, nutritionists, dietetians, industrial hygienists public health engineers, etc. Every one of these course is attracting students from all over India. There is also a scheme afoot in collaboration with the United Nations International Children Emergency Fund, and the World Health Organization for the expansion of the existing courses of training, specially in maternity and child welfare and for starting a new course for public health nurses. It is hoped that these expanded schemes will begin to function in 1952. At the commencement of the Institute, the number of students that were being trained yearly was about 30, but now the number has swelled up to nearly 150. Hostel accommodation which is so essential and a boon to students coming from outside Calcutta has been arranged in a building adjoining the Institute. This hostel accommodates nearly 60 students. Similar arrangements are also being made in the rural centre where the students go for their practical training for several weeks. The All-India Institute of Hygiene and Public Health is the only one of its kind in the whole of Asia and the Far East, to function as a training centre for public health personnel of all known categories.

Investigations and Research: (*a*) *Cholera:* Investigations on cholera started in 1934 and are still proceeding. It is expected that the Institute will continue to give the lead in the solution of the problem until satisfactory results have been obtained. The Section of Epidemiology established the fact that only portions of south-west Bengal could be considered as truly endemic. The area was divided into homogeneous cholera districts of varying degrees of endemicity and epidemicity, wherein further studies to explain these characteristics could be undertaken. It also made systematic and sustained observations in several areas which suggested that cholera cases infected a large number of contacts and environmental sources but in most instances without giving rise to serious outbreaks.

The Section of Microbiology is at present studying the mutation of vibrios to see if these organisms change to forms which have long survival values but no pathogenicity. It is possible that later, under some as yet unknown conditions, they are reactivated to pathogenic forms and some time acquire epidemic properties also. If this could be substantiated most of the obscure points in the epidemiology of cholera would be made clear, including the difficulty in tracing infection from one case to another which, at present, is frequently impossible to do. In a recent paper to World Health Organization, the Professor of Epidemiology has proposed a new lead whereby solution of some of these problems may be obtained.

A cholera enquiry sponsored by the Indian Council of Medical Research and located at the Institute worked out the chemical constitution of cholera and allied vibrios obtained from many sources and came to the conclusion that although the groups were interlocked, the chemical constitution was largely indicative of the nature of origin of the vibrio. This enquiry has shown that six chemical groups of vibrios can be differentiated by means of precipitin tests conducted with the antisera of the organism to be tested against the soluble specific polysaccharides. It was also observed that the organisms developed a lipoid-polysaccharide complex when it is in the epidemic phase. Although no final conclusions were arrived at, these investigations provide the core of knowledge which is likely to prove invaluable in arriving at the final solution of the problem.

The Microbiology Section has recently developed a method for retrospective diagnosis of cholera through study of agglutination response following anticholera inoculation. This method is likely to prove valuable in investigating endemicity and level of herd immunity of endemic areas. This Section is also engaged in the study of biological and other stimuli which make the vibrio change its serological and pathological characters.

(*b*) ***Epidemic Dropsy :*** One of the notable achievements of the Epidemiology Section of the Institute is the discovery of the causal agent and the complete working out of the epidemiology of epidemic dropsy which had remained a mystery disease of the eastern provinces of India for nearly sixty years. At the time of starting the investigation, there were two theories—one suspecting rice and the other mustard oil. The majority, however, believed that the disease was caused by a water soluble toxin elaborated in certain varieties of rice by organisms of vulgatus group. The work of the Epidemiology Section showed that no soluble toxin in the rice was involved and the opacity in the grain which has been supposed to be due to infection, was, in reality, a natural characteristic of certain strains of rice. It also successfully traced the disease to a toxic substance contained in the seeds of a weed called ***argemone mexicana*** which resembles the mustard seed and often got mixed with it before the oil was extracted. This was finally proved through controlled human experiments. Physical and chemical tests by which the toxic oils could be identified were developed and the alkaloid responsible was isolated and given its empirical formula. It is now possible to control the disease which was formerly confused with beri beri, by controlling the seed supply to the oil mills and the distribution of argemone-free oil to consumers.

(*c*) ***Endemic Typhus***: Existence of endemic typhus in India was suspected for many years and the Japanese workers had obtained epidemiological evidence to incriminate the mite as the transmitting agent. But despite many attempts by Japanese and American workers, actual experimental proof of transmission by the mite was never obtained. The Section of Microbiology using an ingenious method not only successfuly bred *T. deliensis* which had so far not been possible and which had proved the main stumbling block to transmission work, but also used these mites in successful transmission experiments. Furthermore, these workers found that the larval stage of *T. deliensis* was parasitic on *Rattus rattus* mainly and that many of these local rats were infected with Rickettsia orientalis. The larva once fed does not feed again, the larva that gets infected cannot spread infection to a vertebrate host except through its progeny. Infection runs through the image of the eggs to the larva of the next generation and these transmit infection. Another point of great interest that has come out of the work is that once a larva is infected the infection is transmitted to at least four generations. This work which is of outstanding quality resolves the difficulties besetting the problem of transmission and control of scrub typhus. Attempts are also being made to study all other mites in the area and to prepare charts for their identification which is at present unavailable and to find out their role in disease transmission.

(*d*) ***Tuberculosis***: India occupies an intermediary stage in tuberculization. According to surveys conducted by the Epidemiology Section in the urban areas, tuberculosis infection roughly approximates that in cities of western countries but in rural areas, infection is low and appears to be largely a matter of contact with urban centres. In industrial suburbs of Calcutta 7% of the general population exhibited active tuberculous lesions and 3% were found to be infectious. The disease was so widespread that risk to non-family contacts was not materially less than that to family contacts. Investigations are now proceeding to work out the epidemiology of rural tuberculosis in relation to urban and industrial centres. In collaboration with the Tuberculosis Association of India the incidence and nature of tuberculosis in relation to jute industry is also being studied.

(*e*) ***Plague***: Plague reappeared in Calcutta in 1948 after 50 years. Many important epidemiological features of the disease were studied. The findings regarding rat movement is of general interest. While the home-range of rats did not exceed 40 yds., these rodents displayed uncanny home sense and some marked rats returned to their original place of capture after release 7 to 8 miles away. This fact was all the more remarkable because journies from the place of capture to the Institute and from there to the place of release were performed in lorries through tortuous streets in the dark, either in covered cages or at night. In undertaking these journeys the rats exposed themselves to the greatest risks from heavy traffic, and enemies like cats and dogs, and while procuring food on the way, from rats belonging to other colonies.

(*f*) ***Black water fever***: The Microbiology Section which studied the aetiology of this disease has shown that intense malaria infection and failure of response of rotioulo-endothelial system played important part in the causation of the disease. Besides there was evidence of upset in the carbo-hydrate and fat metabolisms resulting in the production of haemolytic substances like unsaturated fatty acids and reduction in free cholesterol. Pathological studies showed invariably damage to the zoma fasiculata of the adrenal cortex. Human cases of black water fever were successfully treated with glucose, ascorbic acid and cortin. Highly potent cortical hormone for the purpose was prepared by the workers locally using a technique which is a modification of Swingles' technique.

(*g*) *Maternal mortality*: Child-bearing is a physiological process and like all normal bodily functions it should not be attended with any risk. However, in this country it is a hazardous event. The maternal mortality rate in Calcutta is round about 24. Investigations conducted by the Section of Maternity and Child Welfare has shown that anemia, toxæmia, puerperal sepsis, haemorrhages and accidents of labour were the causes of importance. Since antibiotics can control sepsis, anæmia assumes the most important position. The causes of anæmia in pregnancy are being ascertained and as a preliminary to this work, investigations are being conducted to find out the blood picture in normal pregnancy. The most important finding so far is that most pregnant women show low haemoglobin content of blood largely due to small size of red cells.

Infant mortality rate is 137 ; the principal causes being prematurity and gastrointestinal and respiratory diseases. It was found that premature births occurred in large numbers if the interval between two pregnancies was less than a year and half. In 10% of rural mothers pregnancies occurred within a year.

(*h*) *Reproductive Patterns of Bengalee Women*: An investigation of this subject by the Statistics Section has revealed that consciousness regarding family-limitation is present in educationally and economically well off families. Quite a few of them actually practise family limitation in various ways, more or less successfully. Paradoxically the main reasons are stated to be economic and inability to look after children, but health of the mother is also mentioned. Muslims as a rule desire bigger families. Actually one of the chief factors in lower fertility rate of educated Hindu women in urban areas is higher age at marriage which has advanced much more amongst them than amongst the Muslims or rural Hindus. during the last three decades.

(*i*) *Singur Survey*: An integrated survey which furnishes objective knowledge of man, society and environment is a necessary pre-requisite for the scientific planning of community welfare. It unfolds the problems of the community as also their priority. It gives the assets and liabilities. It provides the objective basis for education and organization through which an enlightened, democratic and responsible community can be created. Given technical assistance and the necessary financial and administrative backing, progressive realization of health, wealth, culture and happiness can be assured. These are the conclusions derived from a scientifically planned survey of a rural area in West Bengal conducted by the Section of Epidemiology in collaboration with the other sections. A Pilot Scheme for reorganization of welfare services in a responsible democratic community has been formulated and submitted to the Planning Commission.

(*j*) *Protein Hydrolysate*: During the Bengal famine of 1943, the Section of Microbiology produced large quantities of protein hydrolysate for intravenous administration to cases of advanced starvation. Using papain for enzymatic digestion and heat coagulation at different *p*H for removal of substances responsible for adverse reaction, it produced a safe product which has not been surpassed as yet by any other make. Combined with glucose and vitamins, this product was used in thousands of cases in an advanced stage of inanition with excellent results. The use of this product saved many lives that would otherwise have been lost. This work has been favourably commented upon by many workers in U.S.A. and England.

(*k*) *Dehydration of plasma*: This was an urgent necessity during the war for treating cases of shock and hæmorrhage. Machinery from abroad was difficult to procure. The section of Biochemistry and Sanitary Engineering designed and constructed an apparatus for the purpose with local talent and material. The plant was successfully worked and many bottles of desiccated plasma and serum prepared. Later on "desivac" was obtained from U.S.A. to deal with larger quantities of serum. During the war, a blood bank service of large magnitude was organized at the Institute and its work was commended by the army and civilian authorities.

The Section of Microbiology, in collaboration with the Central Drug Research Laboratory, developed a test for standardizing processed human serum and plasma, using the cat as the experimental animal. This test is now accepted as one of great value.

(*l*) *Metabolism of Vitamin A*: The workers in the Biochemistry Section have produced a loose combination of Vitamin A, aldehyde and certain fractions of plasma protein which could be held in aqueous solution as molecular complexes. This, they believe, will give a clue to the mode of action of Vitamin A which is not known at present.

(*m*) *Diet and Nutrition Surveys in a rural area*: Diet surveys were carried out at Singur by the Nutrition Section and the most frequent deficiencies observed were in respect of riboflavin, protein, nicotinic acid and calcium. These results were corroborated by clinical examinations. Concurrent "biochemical assessment" did not necessarily run parallel particularly in respect of thiamine, nicotonic acid, riboflavin and ascorbic acid. This is contrary to the experience of workers in other countries. It is for consideration whether different results have been obtained here because of lower level of vitamin reserves and their frequent fluctuations.

(*n*) *Rural sanitation*: It has been found that safe and convenient disposal of night soil and provision of potable water supplies in most rural areas are not beyond reach. The Section of Sanitary Engineering has made a well-latrine which can effectively solve the first problem within the means of the rural population if organized efforts are made. A low bacteriological standard of 10 coliform organism per 100 c.c. of water can be attained in tube wells of moderate depths which can be maintained at about Rs. 8/- per annum each. In this connection, this Section has shown that under the solid conditions of Singur, pollution from bore-hole latrines travels not more than 10 ft. and contamination of tube well water can be easily avoided, if this fact is taken into account while putting them up.

From the foregoing account of the origin, development and function of the All-India Institute of Hygiene and Public Health, it will be seen that its activity and usefulness are ever increasing and it may be hoped that its record of service to the country and to the cause of public health will in the future, as in the past, be worthy of the premier position it occupies today.

Central Drugs Laboratory

The Central Drugs Laboratory is a statutory institution established by the Government of India under the Drugs Act. The various sections of the laboratory are housed at three different places, the All-India Institute of Hygiene and Public Health and the pathology building of the Medical College. The Pharmacognosy Section is at the Indian Museum.

The scope and functions of the Central Drugs Laboratory are given below:

(1) To grant certificates of registration for patent and proprietary medicines with undisclosed formulae after carrying out the necessary analysis ;

(2) To test imported drugs and declare whether they are of standard quality ;

(3) To act as the official referee in matter of disputed analyses regarding the composition of drugs on reference from the law courts and collectors of customs ;

(4) To promote, guide and co-ordinate research on drugs and to disseminate information regarding standards of drugs in tropical climates ;

(5) To train workers on drug standardization and drug research: and

(6) To act as the national distributing centre for international standards of drugs.

The laboratory is composed of five different sections, viz., pharmaceutical chemistry, bio-chemistry, pharmocology, bacteriology and pharmacognosy. Till recently the laboratory was the only one of its kind for the whole of India and requests for opinion and analysis of drugs from various organizations such as Defence, State Government, Ministries of the Government of India, etc. were met with. The analysis of and research on drugs require the employment of a great variety of modern techniques and most of them have been developed in this Laboratory keeping abreast of modern scientific developments in this field. The assays of hormones, antibiotics, and vitamins requiring microbiological techniques are all carried out as a routine measure.

Valuable contributions on indigenous drugs and substitutes for pharmacopoeial drugs, blood coagulation, vitamin B_{12}, the most potent anti-pernicious anaemic principle, venoms and hormones have been made by the workers of this Laboratory. Various chemotherapeutic and toxicity tests on new drugs are also being carried out.

As this Laboratory was the pioneer on drug testing in all its comprehensive aspects, workers from all parts of India and Pakistan have been deputed for training from time to time. After the successful training over varying periods according to their needs, they are now occupying positions of responsibility in State Governments or medical colleges.

Indian Institute for Medical Research

It claims to be the first non-medical research institute in this country. It was founded in 1935 with Dr. J. C. Ray as Director and is located at present at P-27 Princep Street, Calcutta.

The Institute has since 1941 been publishing a journal called *Annals of Biochemistry and Experimental Medicine.* It has to depend largely on public support which has not been of a sufficiently adequate character. Consequently the workers of the Institute have in spite of the many valuable results already obtained not been able to extend their scope of research. The diagnostic section is a source of income of the Institute ; it has served as a training ground for research students and provided lead for research work. Three of the Institute's research workers have during 1950-51 received fellowships in American universities. Many of the principal research workers work on a voluntary basis. Some of the important researches are summarized below.

Under the guidance of Dr. B. C. Guha, the Institute has carried out a good deal of pioneering work with regard to nutritional problems, particularly in relation to food stuffs and dietaries of Bengal. Researches on chemistry, immuno-chemistry and chemotherapy were carried out under the direction of Dr. B. N. Ghosh. Bacteriological researches under Dr. H. N. Ghosh are concerned with the problems of cholera infection and cholera immunization etc. The Director Dr. J. C. Ray has since 1935 been engaged with the problem of protozoal cultivation and protozoal immunity. Cultivation of malaria parasites, preparation of malaria antigens from *P. Knowleski,* studies on antibody response in malaria, are some of the problems which have been investigated. Considerable work has been carried out on allergy, including therapeutic trials with urinary proteases.

Calcutta Dental College and Hospital

The Calcutta Dental College at 114, Lower Circular Road, Calcutta which was founded by Hon'ble Dr. R. Ahmed has been brought under the direct management of the Government since February 1950. At present it is the only dental institution affiliated to the State Medical Faculty of West Bengal. The object of this institution is to educate youths in dentistry and to render specialized services to the people.

At present L.D.S. course of the State Medical Faculty of West Bengal is being taught at the institute. This qualification is recognized under the schedule of the Indian Dentists Act (Act XVI of 1948) and is registrable in the Republic of India. The course covers a period of 4 years for non-medical personnel. The minimum preliminary qualifications for admission into the College are that a candidate must have passed the matriculation examination from an Indian university in the first division or an examination considered equivalent to it. For qualified medical practitioners, the course is for a period of 2 years. The session commences from July every year. Arrangements have been made for providing all modern teaching facilities in the College in association with the Nilratan Sarkar Medical College where training in the medical subjects, *viz.*, general anatomy, including dissection, physiology, medicine, surgery, pathology and bacteriology will be given. A new two storied building for the hospital is under construction. The Government has also proposed to instal a plastic tooth manufacturing plant to meet the demand of the present need of the country.

Admission to the college is open to students, male and female, whose parents are domiciled in West Bengal. Refugee students from East Bengal are also eligible for admission. Candidates from other States may be admitted with the prior arrangement that may be made by those State Governments with the Government of West Bengal. New buildings are being constructed and efforts made for the introduction of the B.D.S. course under the University of Calcutta. The Indian Dental Council has prepared a uniform carriculum of study for the B.D.S. degree throughout the country, and it is hoped that this college will be able to prepare students for the B.D.S. course early.

Bengal Veterinary College

The Bengal Veterinary Institution, established in 1894, owed its existence to the munificence of Sri Shew Bux Bagla, Sir Dinshaw Manockjee Petit and Dr. McLeod of Calcutta Medical College, and was largely the result of hard work and enterprise of Col. F. C. Raymond, the first Superintendent of the Civil Veterinary Department, Bengal. It then consisted of Kenneth McLeod Veterinary School and Sir Dinshaw Petit Veterinary Hospital, situated on a plot of land of about 76 acres. Originally, the Institution comprised of two year certificate course, but it was converted into a College in 1906, when a three year course was prescribed. The diploma conferred was Graduate of Bengal Veterinary College. In 1933, though the period of training continued to be three years, the nomenclature of the diploma was changed to Graduate of Veterinary Science.

Animal Husbandry Education: The application of veterinary education chiefly concerned ailment in the equines, whereas the bovines were more or less of secondary importance. Since 1933, veterinary education has been reconstituted and additional subjects such as animal nutrition, biochemistry, parasitology with special reference to practical methods of ecto and endo parasitic disease control, genetics, artificial insemination, management of diary cattle, dairy bacteriology, milk hygiene, milk and meat inspection, poultry diseases, poultry husbandry etc. were introduced.

Since the Veterinary Education Committee of the Indian Council of Agricultural Research stressed the need for standardizing veterinary education throughout the country at the same level, the question of a four-year degree course for the Bengal Veterinary College affiliated with the Calcutta University was duly taken up and a formal application submitted to the University authorities in October 1951.

The College provides a refresher course for post-graduate study and also short course of training for dresses, compounders, farriers and in poultry husbandry.

The College also provides facilities with regard to research activities to graduates of medical profession as well as to graduates of zoology.

Research: Veterinary research in Bengal, after Raymond, had practically continued in a disintegrated manner upto 1932, when it was revitalized under the auspices of the then Imperial Council of Agricultural Research in India, with the appointment of a veterinary investigation officer in Bengal. Some very valuable contributions to animal disease problems were made under the scheme. Several other schemes, *e.g.*, scheme for investigation of poultry diseases, diseases in sheep and goats, investigation on helminthiasis, were also initiated from 1942. A scheme into the survey and bacteriological examination of samples of market milk in all stages of transit from the source to the consumer's door has been taken up since last year and is making good progress. A scheme for investigation into the causes of degeneration of cattle in humid climate has been approved to be worked out in the Bengal Veterinary College.

Investigation and determination into the causes of sterility in cattle together with remedial measures forms the subject of another scheme recently approved of by the Government.

Biological Products Section: Manufacture of goat tissue vaccine for cattle plague and Ranikhet disease virus vaccine is carried out at the Biological Products Section Laboratories, and a small substation at Kurseong. There is a scheme for establishing sub-depots for the storage of Ranikhet disease virus vaccine where other biological products can be stored at suitable centres in the State, for the purpose of prompt supply of sera, vaccine etc., in the affected areas without the slightest deterioration in the potency during transit.

Hospitals

THERE are various types of hospitals, State, non-State and State-aided, in Calcutta, some of which are in connection with medical colleges and schools. The number of such hospitals is 36 with 5,981 beds. Besides, there are 31 dispensaries for out-patients only, which are run by the Calcutta Corporation and other private organizations. The following hospitals are attached to the respective medical colleges:—(1) Calcutta Medical College and Hospital with 798 beds; (2) Nilratan Sarkar Medical College Hospital with 712 beds; (3) R. G. Kar Medical College and Hospital with 556 beds; (4) Calcutta National Medical Institute with its 2 hospitals, namely: (i) Calcutta Medical School Hospital with 170 beds; (ii) Chittaranjan Hospital with 175 beds; (5) Presidency General Hospital with 245 beds, Sambhunath Pandit Hospital with 142 beds; and (6) Lake Medical College Hospital with 379 beds.

A brief note on the history of the important hospitals is given below:

Medical College Hospitals

Soon after the opening of the Medical College, it was felt that the teaching of the theory and the elements of medicine could not be properly imparted without the aid of a hospital. Thus a ward with 30 beds was opened for the admission of patients on April 1, 1838 along with an outpatient department. In 1840, a female (lying-in) hospital was constructed to accommodate 100 patients. In 1844, the hospital had three wards accommodating 112 beds. From about the 'eighties of the last century steady progress in the development of the hospitals is recorded.

The Eden Hospital was opened in 1881, the Shama Charan Law Eye Infirmary in 1891, and the new Outdoor Dispensary was completed and re-opened on June, 14, 1898. In 1910, the Prince of Wales Hospital was completed. The new Eye Hospital formally came into existence in 1926. Besides, mention may be made of the Sir John Anderson Casualty Block.

The Out-door Departments are: (*i*) Medical Out-patients Department, (*ii*) Surgical Out-patients' Department, (*iii*) Maternity Out-patients' Department, (*iv*) Eye Out-patients' Department, (*v*) Chest Department, (*vi*) Neurology and Psychiatry Department, (*vii*) Fracture Clinic, (*viii*) Skin Department, (*ix*) Dental Department, (*x*) Ear, nose and throat Department, (*xi*) V. D. clinic, and (*xii*) X-ray Department.

The Medical College hospitals occupy a total area of nearly 83 bighas of land. There has been an all round expansion and the hospital has been completely modernized and facilities for treatment of all kinds of diseases have been provided The attached hospitals have a normal accommodation for 798 patients but during recent years it has been running an extra of about 300 beds in addition. There are at least ten operation theatres. The activities of the hospitals can be easily imagined from the fact that last year about 32,000 were treated as in-patients and about 10,00,000 received medical attention in the various Out-patients' Departments.

Nilratan Sarkar Medical College Hospital

The Campbell Hospital, Sealdah, was opened in 1867 as a pauper hospital. In 1873, it was attached to the Campbell Medical School. This hospital was almost entirely rebuilt in 1908-10. The school has been upgraded into a college since 1947 and the name of the Campbell Medical School and Hospital has been changed to Nilratan Sarkar Medical College and Hospital. The Nilratan Sarkar Hospital comprises of a very large area of land where various wards have been constructed or are under the process of construction.

Presidency General Hospital

The hospital on its present site dates as far back as 1770. It was intended mainly for the European and Anglo-Indian patients. In 1795, a new wing was added. In 1898, the foundation stone of a new block, now called the main block, was laid and the old hospital buildings, which had served their purposes, gave place to a new and modern hospital.

On October 2, 1951 a new department, *e.g.*, the Electro-Encepalography Department was opened.

This hospital, originally intended for only European and Anglo-Indian patients, gradually began to take in Indian patients also. After August, 1947, the hospital doors were thrown open to all patients, irrespective of caste or creed.

The hospital is soon going to be reorganized under the munificence of the Karnani Trust and the bed strength will be brought up to 500 with provision of special beds for diseases of the heart, poliomylitis etc. and facilities for physiotherapy and electro-therapeutics, and has been earmarked as a centre for post-graduate studies and renamed S. S. Karnani Memorial Hospital.

Sambhu Nath Pandit Hospital

The forerunner of the hospital was the Bhawanipur Dispensary opened in 1840. It was entirely maintained by Government up to 1871, when it received a grant of Rs. 21,445 from the Sambhu Nath Memorial Fund on condition that the dispensary should be named after Sambhu Nath Pandit. In 1894, the Calcutta Corporation provided a site in Elgin Road where the new hospital was built on the north side of the road. In 1908, the Corporation handed over to the Government, for the extension of the hospital, a block of land situated on the north-east of the hospital grounds. It is proposed to build a new hospital in its compound to provide 140 more beds in addition to the existing 142 beds.

Lake Medical College Hospital

The American Military Hospital established during World War II was taken over by the Government after the end of the war and the Lake Medical College was opened in April, 1947 for a period of 5 years to enable medical licentiates with war service to obtain degrees after a course of study varying from 18 months to 2 years. The hospital had 707 beds, but 328 beds were reduced by June 30, 1951 and the hospital is expected to be closed by April 30, 1952.

Lady Dufferin Victoria Hospital

The hospital was founded in 1886 by the Countess of Dufferin Fund for women. The hospital was provincialized in 1949. The present hospital building constructed in 1938-39 has an accommodation for 274 beds, and it is proposed to be expanded in the near future.

Prince Golam Md. Charitable Dispensary & Hospital

The dispensary was established in the early 'eighties. At present there are 17 beds and an outdoor dispensary. It is proposed to build a full fledged hospital, with 200 beds and with a modern outpatients department for which donation has been received from Sri Ram Kumar Bangur. The dispensary will be named as Prince Golam Md. Charitable Dispensary and the hospital will be designated as Ram Kumar Bangur Hospital.

Hospital of the School of Tropical Medicine

The foundation stone of the School was laid in 1914 and that of the hospital in 1916. At the present time certain departments of the School are staffed and maintained by the Goverenment of West Bengal while others are financed from the Endowment Fund of the School. The hospital is entirely financed by the State Government. The institution consists of (1) the School Department, (2) the Carmichael Hospital for Tropical Diseases with 106 beds; and (3) one Outpatients Department. The activities of the School have expanded and there are nearly 20 departments, each busily engaged in the conduct of research in addition to routine hospital and teaching work.

Calcutta National Medical Institute

Two non-Government organizations, Jatiya Ayurbijnan Parishad (National Medical Council) and Calcutta Medical Institute, have been amalgamated into one and named as the Calcutta National Medical Institute. Three hospitals are attached to this institute—Calcutta Medical School Hospital with 170 beds, Chittaranjan Hospital with 175 beds and the National Infirmary with 100 beds, but the last named was due to be closed by December 31, 1951.

Calcutta Medical School Hospital: In 1908, the National Medical College of India and the National College of Physicians and Surgeons of India were started. Two years later a hospital named Calcutta Free Hospital was attached to the institution. In 1914, the hospital was shifted to 301/3, Upper Circular Road and the Calcutta Medical School was affiliated under the State Medical Faculty in 1923.

National Medical Institute with the Chittaranjan Hospital and the National Infirmary: In 1920, through the initiative of late Deshabandhu Chittaranjan Das and others, a National Council of Education was formed with its location in a building at 11, Wellington Square with a medication section. The location was then shifted to Manicktola Main Road. Here a hospital called the National Infirmary for the destitutes was established. In 1921, the late Deshabandhu laid the foundation of a medical college, called the Jatitya Vaidya Sastrapith or the National Medical Institute independent of the alien Government of the time. In 1923, a large plot of land was obtained on Gorachand Road for the establishment of a hospital and with contributions from the public a large hospital was built accommodating 100 beds. The hospital was named Chittaranjan Hospital after the name of the late Deshabandhu Chittaranjan Das, and it is proposed to be expanded by another 200 beds in the near future.

Mayo Hospital

The Mayo Hospital was opened in 1874 and provided indoor accommodation to 120 patients. In 1936, a separate outpatients department was created by erecting a two storied building. The Mayo Hospital is under a governing body and has accommodation for 150 patients. It also runs two separate dispensaries, one at 4, Temple Street and the other at 209, Upper Chitpore Road, Calcutta.

K. S. Ray Tuberculosis Sanatorium, Jadavpur

In 1918, a young man bequeathed the whole of his property worth Rs. 1,73,000 to be utilized for the purpose of establishing a tuberculosis hospital. To give effect to his wish, a society called the Calcutta Medical Aid and Research Society was formed. By 1923 they constructed a small building with accommodation for 4 beds which formed the nucleus around which the hospital has developed today. The hospital now stands on an area of about 45 acres of land. The existing number of beds in this hospital is 340. It has also a branch at Kurseong, known as the S. B. Dey Sanatorium, with 60 beds.

After the death of Dr. K. S. Ray, who was associated with the hospital for a long time, the name of the hospital has been changed to K. S. Ray Tuberculosis Sanatorium.

Chittaranjan Seva Sadan

Chittaranjan Seva Sadan, named after the great patriot Deshbandhu Chittaranjan, was opened in 1926 with 22 beds and also an outpatients department. This institution is being gradually expanded. At present the institution has the following departments: (1) Indoor obstetric; (2) Indoor gynaecological; (3) Radium and X-ray; (4) Physiotherapy; (5) Children hospital; (6) Outpatients' department; and (7) Nurses' training. The Seva Sadan has a total number of 214 beds.

Chittaranjan Cancer Hospital

Chittaranjan Cancer Hospital founded on June 5, 1948 was formally opened by Madam Irène Curie on January 12, 1950. The hospital, like the Seva Sadan is under the management of the Deshabandhu Memorial Trust.

The hospital has (1) Outpatients' Department, (2) Indoor Department, (3) Clinical Laboratory, (4) X-ray Department and (5) Radium Department. (1) has four sections, *e.g.*, general and surgical; ear, nose and throat; gynaecological; and dental. During 1950-51, 6,455 patients received treatment, of which 1,525 were new cases. (2) has 78 beds, including 8 cabins; very shortly the number of beds will rise to 150. The Clinical Laboratory (3) is engaged in cancer research. Setting up of up-to-date laboratories for biophysical, biochemical, histopathological work, for animal experimentation and for physical and biological assay of x-ray and radium radiation, is under progress. The X-ray Department (4) has installed one million-volt x-ray apparatus, one Maximan 250, two Stabilivolt machines, one contact and cavity therapy machine, one x-ray diagnostic machine and one diathermy machine. Thus equipped the hospital is the leading centre for cancer research and treatment in India. During 1950-51, 6,633 patients received treatment in this department. The Radium Department (5) has 1200 mgm. of radium in different needles and capsules, and 459 patients received attention here.

Shree Vishudhananda Saraswati Marwari Hospital

This hospital was opened in 1919 on a plot of land measuring about 4 bighas at Amherst Street. Beginning with a modest number of 40 beds the hospital now runs 181 beds.

Ramakrishna Sisumangal Pratisthan

This institution, located at 90 Lansdowne Road, was started in 1932. It is an up-to-date maternity hospital and child welfare centre with 130 beds. This institution is being gradually expanded to meet the growing needs of the population.

Lumbini Park (Mental Hospital)

The Lumbini Park (Mental Hospital) was started under the auspices of the Indian Psycho-analytical Society on February 5, 1940 with 3 indoor beds. A free outdoor department for mental cases and another for general physical diseases were also started simultaneously. At present, there are 90 beds, 32 in the female ward and 58 in the male, including 2 free beds. The society aims at increasing the capacity of the hospital to at least 250 beds. A city outdoor clinic named Lumbini Clinic has also been started at 14, Parshibagan Lane, with two separate sections, one for normal children and another for mentally deficient and problem children.

Jamini Bhusan Astanga Vidyalaya

Subsequently named after its founder Kaviraj Jamini Bhusan Roy, the Ashtanga Ayurveda Vidyalaya was founded in 1916 and is the pioneer college in Bengal teaching the Ayurvedic system of treatment with a general and a tuberculosis hospital attached to it. In 1918, the Calcutta Corporation sanctioned an annual recurring grant of Rs. 2,500/- for the outdoor dispensary attached to the college—the first recognition granted to an Ayurvedic institution. Next year the institution was registered as a public body with Sir Asutosh Mookerjee as the President of the Board of Trustees.

In 1922, a new plot of land measuring about 1 bigha and 14 cottas was secured from the Calcutta Corporation on 99 years' lease at a nominal annual rent of Re. 1/- only. A sum of Rs. 70,000 was raised from various sources towards the construction of new buildings of the college. It was on this plot of land that the foundation-stone of the building was laid by Mahatma Gandhi on May 6, 1925. The college and the outdoor dispensary were removed to the building on January 1, 1926.

The college soon attracted students not only from all parts of India but also from Ceylon and at one time had on its rolls nearly 300 students. A female ward was added to the General Hospital. A Tuberculosis Hospital was started as a part of the institution in 1934 in a garden house in the outskirts of Calcutta which had been bequeathed by Jamini Bhusan together with some properties in Calcutta, Ranchi and Kurseong valued in all at Rs. 1,47,403.

A plot of land adjoining the main building was purchased at a cost of Rs. 15,000 on which the present college building now stands.

The Tuberculosis Hospital with its newly constructed ward has accommodation for about 80 beds. The hospital is equipped with a modern x-ray plant installed recently.

The General Hospital accommodates 125 patients while the outdoor department gives daily relief to a large number of patients.

Recently the West Bengal Government have given grants of Rs. 20,000 and Rs. 10,000 for the specific purposes of repairs to the building and for replenishing the equipments of the hospital.

The institution has in contemplation (1) the opening of a refresher course of studies ; (2) the expansion of the research department ; (3) the exploring of the possibilities of establishing a hospital for treatment of mental diseases ; and (4) the establishment of a hospital for the treatment of patients suffering from leprosy.

General Remarks

(1) In addition to the above hospitals, there are 2 Auxiliary Government Hospitals accommodating 350 patients. These were started during the war period.

(2) A separate Infectious Diseases Hospital is proposed to be built in Beliaghata in the near future so that all infectious diseases patients will be removed from Nilratan Sarkar Hospital.

(3) All the large hospitals and teaching institutions provide training for nurses—junior and senior training—and also in midwifery.

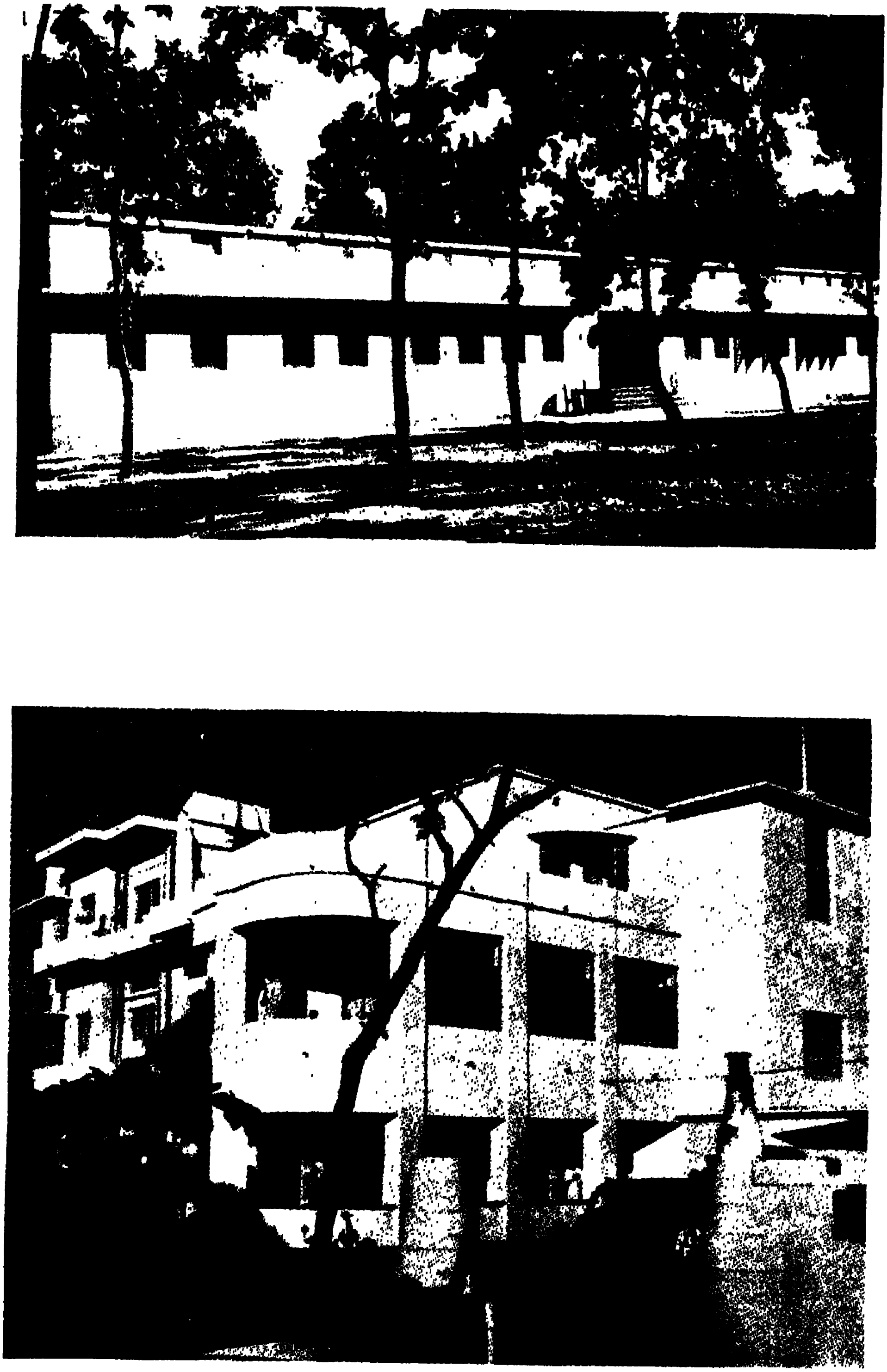
8. AGRICULTURAL

Agricultural Education In West Bengal

HIGHER agricultural (collegiate) education has so far remained a subject within the purview of the Department of Agriculture. Obviously it has been so because, unlike in medical and engineering lines, the scope for employment of agricultural graduates in agricultural line is limited. Under the existing socio-economic conditions private farming is not remunerative and opportunities of employment under the Department of Agriculture or private agricultural organizations are limited. The main object of higher agricultural education has, there-

MILLION VOLT X-RAY TUBE OF CHITTARANJAN CANCER HOSPITAL
(PHOTO SHOWS MME. IRENE CURIE)

JAMINI BHUSAN ASTANGA VIDYALAYA



STATE AGRICULTURAL RESEARCH INSTITUTE, TOLLYGUNGE fore, been for the purpose of supplying technical personnel for the Agricultural Department. The Government have naturally been cautious about turning out men who would not be employed. As a result agricultural education has so far remained under a check.

On the other hand, it is agreed on all hands that want of education in the field of agriculture and rural life has adversely affected our agricultural products. With a view to a revival of interest in agriculture and rural life it has now been decided to give stress on agriculture in basic and also in secondary education. But it is also important to develop agricultural collegiate education in order to produce teachers with appropriate training in the social and technical aspects of agriculture.

When scope for employment as a line of professional education was limited the best way to spread and popularize agricultural collegiate education was to set it up as a faculty of general education keeping parity with those in arts and sciences. The great advantage here is that a judiciously designed agricultural course, between the subjects of its study—humanities, sciences and technology, provides a most useful curriculum for a more complete education about nature and man.

Regulations relating to the agricultural courses of the Calcutta University have been formulated in view of the above considerations. The aim in doing so has been (1) to popularize knowledge of the problems and progress of agriculture with the greatest possible educational advantage, (2) to turn out men with appropriate social and technical background for becoming agricultural teachers and taking leadership in rural reconstruction, and (3) to supply trained personnel for agricultural department and research. Through the I.Sc.Ag., B.Sc.Ag., and M.Sc., D.Phil and D.Sc. courses, the University has designed a progressively developing course of agricultural education towards specialization having its foundation on a broad basis. As in the case of arts and science, each course is preparatory to the next higher course and at the same time complete by itself on its own standard. The University proposes that apart from their agricultural education these courses should be given the recognition of general university education of the respective standards for admission into other courses of university studies and services of the society and the State. Thus agricultural education will not suffer from any limitation but have sufficient scope for the purpose of agricultural development of the society irrespective of its present handicap as regards employment in agriculture proper.

The type of departmental colleges, as they are planned at present, need a large capital expenditure on buildings and equipments which are meant only for the purpose of teaching a limited number of students, and a large recurring grant for the maintenance of the college. The cost would appear practically prohibitive for private initiative to establish and maintain agricultural colleges. The University, however, thinks that colleges teaching arts and science courses could quite easily teach agriculture as well only by the addition of a farm technology section with the necessary staff and a demonstration farm for practical work of students. As large chemical factories need not be maintained for teaching chemistry or chemical technology so large farms are not required to be maintained by agricultural colleges for teaching purposes.

Agricultural College and Research Institute, Jhargram

With a view to serving as a model for such a college, the University of Calcutta established in 1949 the Agricultural College of Jhargram (Midnapore) with a nucleus of Rs. 1,00,000 in cash and about 150 acres of land donated by the Raja of Jhargram, and started I.Sc.Ag. and also I.Sc. and I.A. classes. The college is situated in the town of Jhargram on 17 acres of land with the college building and sites for play-ground, hostel, etc., situated on 7 acres of land and a demonstration farm on 10 acres. B.Sc.Ag. Class has been started in 1951. At present there are over 300 students on the rolls about 75 per cent of whom are studying in the various agricultural classes.

Arrangements have also been made for conducting the work of the Post-Graduate Department of Agriculture of the University at Jhargram. The remaining 133 acres of land donated to the college is situated, two miles from the town, in the rural area for the purpose of a research farm for the study of socio-economic, scientific and technical problems of agriculture. The plan of the Institute is to organize the research farm so as to provide facilities for studying agricultural problems on a co-operative background. An area of 100 acres will be divided into 10 units of 10 acres each having differences in respect of the lie of the land and soil conditions. For co-ordinating, providing central facilities and administering these separate units, there will be a central organization under a teacher. Each individual farm will be managed by a post-graduate student and a farmer assistant (village cultivator employed as such). Between the post-graduate student and the assistant the farm will be managed under the general direction of the Khaira Professor of Agriculture and teachers concerned. They will work as peasant proprietors as also trainees, the post-graduate student devoting himself more on the scientific side and the farmer assistant on the practical side. On completion of his course of study the post-graduate student will be replaced by a new student and also after 2 or more years of training the farmer assistant will be replaced by a new comer. Thus educated scientific men and village cultivators receiving practical training in modern methods will be turned out from the Institute and at the same time research studies will go on.

The research farm will be organized on a co-operative basis co-ordinating, as far as possible, the facilities provided by the Government for agricultural and rural development and popular initiative. Work of developing the farm has already been in progress with the help of a Cotton Development Scheme of the Government. An irrigation project for the locality including the farm is now under consideration of the Government of West Bengal.

Agricultural Research

IN West Bengal, agricultural researches are done mainly by the State Agricultural Department, but some amount of research work, mostly of fundamental type, is also done in the University of Calcutta and in other educational institutions. The State Department generally deals with problems of practical importance with the sole object of increasing the production of the country.

State Agricultural Research Institute

The main centre of research activity of the State Department is the State Agricultural Research Institute at Tollygunge, which was started in 1950. Problems of diverse types are being studied here and it is hoped that the Institute, in course of a few years, will make valuable contribution towards the agricultural development of the State. Field experiments are conducted in the Govt. farms of which there is one in each district. The establishment of so many farms has provided facilities for studying a problem under different soil-climatic conditions. These farms are managed by the qualified staff who carry out experiments in accordance with the instruction of the expert officers. In some of the farms, a section of the research staff is posted permanently so as to facilitate proper and constant supervision of the work. In addition, experiments are sometimes conducted in the cultivators' plots. There is at present a great need for expansion of the Institute and steps have already been taken in this direction.

Agricultural Research under the Agricultural Directorate

The Research Branch of the Directorate of Agriculture at present consists of the following sections, some of which were created after the partition of Bengal:

1. Crop Research Section.
2. Economic Botany Section.
3. Potato Section.
4. Sugarcane Research and Development Section.
5. Agricultural Chemistry Section including Microbiology and Biochemistry Sections.
6. Mycology Section including Plant Pathology.
7. Entomology Section including Plant Protection.
8. Horticulture Section.

The Crop Research Section deals with oilseeds, pulses, cotton, coconut and other miscellaneous crops, while cereals, millets, fodder and fibre crops were assigned to the Economic Botanist. Separate sections were created for study of potato and sugarcane, the two important crops of the province.

Crop Research Section: Several research schemes, financed by different Commodity Committees are being worked out in this Section. The Oilseed Scheme, financed by the Indian Central Oilseed Committee, was started in 1950 with the object of collection, selection and breeding of suitable types for

West Bengal. In the Pulse Research Scheme, dealing with rahar, soyabean, mug, gram, lentil, etc., tangible progress has already been made in the selection of suitable types of rahar and soyabean. Initiated by a Cotton Departmental Scheme, a rainfed type of long staple cotton, *viz.*, Parbhani-American, already selected by this Section as suitable for West Bengal, is now in the developmental stage with a target of 5,000 acres during the first year (1951-52). Selection of suitable rabi cotton types is also in progress.

Two other schemes which have started functioning from this year is Coconut Nursery Scheme and Arecanut Nursery Scheme. Amongst the other activities of this Section, introduction of tapioca and roorka from Travancore may be mentioned.

Economic Botany Section: The Rice Research Stations at Chinsurah and Bankura have made notable contributions on paddy during the pre-partition days. These two stations are continuing the useful work in the selection and breeding of better types of *aman*, *aus* and *boro* paddy suitable for all the different districts of West Bengal. A new line of activity in paddy research is the introduction of flood, saline and drought resistant types with a view to bringing in more areas under this important food crop. Agronomic trials for the introduction of double and triple cropping of paddy areas with suitable short duration types of *aus* and *boro* paddy are in progress. Trials conducted at different places of West Bengal with Assam and Orissa types show great possibilities.

A Maize Breeding Scheme has recently been started for breeding suitable types for the hill district of West Bengal. This scheme is being run at Kalimpong in the Darjeeling district. Introduction of hybrid maize from U.S.A. has given very encouraging result and suitable types have been selected.

Researches on the introduction and acclimatization of suitable types of wheat for West Bengal are in progress.

Potato Section: Field experiments of this Section are mainly conducted at Rangbull and Bhanjan Farms in the Darjeeling Hill tracts and in Burdwan Farm in plains. Different potato varieties and hybrids are being tried in the plains as well as in the hills. Experiments on rotation, size of tuber, types of manure, fertilizer mixtures and effect of hormones are being carried out. Inter-varietal breeding is being carried on with large number of varieties imported from Canada, Australia, U.K. and Denmark along with the local varieties. So far Rangbull Selection No. 3, 9 and 35 proved most successful.

Sugarcane Section: The work of this Section is mainly confined to the varietal and manurial trials, selection of suitable types and multiplication and distribution of sugarcane setts for extension of sugarcane cultivation in the State.

Agricultural Chemistry Section including Microbiology and Biochemistry Sections: Besides extensive advisory work on problems relating to soils and fertilizers, the Agricultural Chemistry Section is conducting experiments in different centres to determine the optimum manurial requirement of crops grown under different soil-climatic conditions. An I.C.A.R. Scheme to determine the effect of continuous application of ammonium sulphate to paddy land has been in progress for the last 4 years and the results so far obtained do not demonstrate the harmful effect of ammonium sulphate on soil fertility.

Recently a scheme, financed by I.C.A.R. and known as Stewarts' Scheme, to conduct simple manurial trials in cultivators' plots, has been undertaken and experiments in 50 centres in the districts of Burdwan and Hooghly have been started to study the effect of ammonium sulphate, added singly and in combination with superphosphate, on paddy and jute.

In the Microbiology Section, work is being conducted to study the effect of seed inoculation with efficient strains of nodule bacteria on the yield of some pulse crops.

In the Biochemistry Section, the suitability of Calcutta sewage effluent as manure and for irrigation purposes and sludge as manure is being worked out.

Mycology Section: The work of this Section consists of research on the important diseases of major crop plants, survey, advisory and seed certification. Some valuable contributions have been made on the fungicidal control of some of the most important diseases of crop plants particularly paddy and potato.

Entomology Section: In addition to survey, advisory and seed certificate work, this Section is conducting research schemes on lac cultivation, sugarcane pests and stem borers and hispa of paddy.

Horticultural Section: In view of the importance of banana cultivation in this State, a Banana Research Scheme has recently been started at Krishnagar Horticultural Farm under the auspices of the I.C.A.R. for improving the quality of local types by breeding and selection. This Section is also doing a great deal of work in the introduction of better varieties of mango, citrus, pineapple, litchi, etc. to stimulate the development of fruit and vegetable cultivation.

Agricultural Research in other Scientific Institutions

Of the other scientific institutions in Calcutta carrying out agricultural research, special mention may be made of Bose Institute, Departments of Botany of the Presidency College and Science College of the Calcutta University.

The Bose Institute has been carrying on important researches on plant life and agricultural aspects for the past several years . Special mention may be made in this connection of the famuos plant physiological researches of the founder himself and the subsequent work carried out in the Institute on the effect of hormones on rooting, etc., vernalization experiments and effects of irradiation on jute and cotton. A number of research schemes on crops like cotton, jute, oil seeds, etc. financed either by the State Government or by the Central Commodity Committee of the respective crops are now functioning in this Institute.

In the Department of Botany of the Presidency College work has been done on the photoperiodic response of some of the crops such as mustard, til, jute, etc.

The Department of Botany of the Calcutta University has also contributed to the agricultural research of the State by working out the water requirements of paddy, vernalization of paddy, effect of colchicine treatment on crop plants, classification of mango and cytogenetical work on banana,

Jute Agricultural Research

What is Jute

JUTE is the fibre obtained from two cultivated species of annual plants *Corchorus capsularis* and *Corchorus olitorius* grown in the alluvial soils of India in West Bengal, Bihar, Assam, Orissa, Tripura and U.P. and in Pakistan (East Bengal). It is a kharif crop and is commonly sown broadcast during February to May. Two to three inches of rainfall during sowing and alternate periods of sunshine and moderate rainfall thereafter, seem to be ideal for the growth of the jute crop. Jute cannot stand water-logged conditions or continued rains in the early growing stage but can do so to some extent only after it has attained considerable height. *Corchorus capsularis* can stand both water-logged and drought conditions better than *Corchorus olitorius.*

In harvesting the plants are cut close to the ground, often under water in flooded fields. Cut plants are tied into bundles and steeped under water for retting. On higher lands the bundle of plants are left for two to four days to shed their leaves before steeping them in water for retting. In 12 to 25 days, depending on the temperature to volume of water, the retting is complete. The fibre is then carefully separated from the stalks, washed and dried when it is ready for various commercial purposes.

Jute Industry

Although the plants are known since very early times, jute was never cultivated to a great extent until early in the nineteenth century. The early English traders in India, in their attempt to find out a good substitute for flax and hemp, thought of utilizing the jute fibres, and in 1793 they were shipped to England.

The export of raw jute from India increased considerably and Dundee, once the most important centre for flax industry, soon became the most important centre for jute industry. The first jute mill in India was set up in 1855 at Rishra near Calcutta. This was gradually followed by a large number of jute mills along both sides of the river Hooghly.

Jute Research

Till the beginning of the 20th century no attention was paid to the research on jute fibre, particularly on the development of high yielding types and the improvement of agricultural practices. although it became the most important money crop of Bengal due to the continuously increasing demand of raw jute and jute goods from abroad. In 1906 a Fibre Section was inaugurated under the Department of Agriculture, Bengal with the appointment of Mr. R. S. Finlow as the first Fibre Expert. This provided a permanent specialized organization for carrying out agricultural researches into the most important cash crop of the Province. Mr. Finlow carried out important research work on jute and evolved two improved strains—D154 (a capsularis strain) and C. G. (an olitorius strain).

The Royal Commission on Agriculture in India (1926 28) recommended that an Indian Central Jute Committee should be established, on the lines of the Indian Central Cotton Committee, to watch over all branches of the trade from the field to the factory. Later in 1933 the Report of the Bengal Jute Enquiry Committee revived public interest in jute and the Indian Central Jute Committee registered as a Society under the Registration of Societies Act, XXI of 1860 was established in 1936.

Agricultural Research

Soon after the Jute Agricultural Research Laboratories were set up at the Dacca Farm and its three Jute Research Sub-Stations in Eastern Bengal. The main items of research included:—(a) production of strain giving fibres of superior quality without affecting yield, (b) the influence on variety, growth and retting conditions of jute, (c) control measures on disease and pests, (d) breeding disease resistant types of jute and improvement of retting technique. In addition to these, research works on genetics, interspecific hybridization, cytology, anatomy, trials with different fertilizers and manures, isolation of the proper type bacteria for retting jute and various other fundamental subjects have been carried out.

Breeding of high yielding strains: The Agricultural Institute of the Indian Central Jute Committee was successful in evolving a number of high yielding strains of jute. Three capsularis strains evolved have been tried under cultivators' conditions over a wide area under varying climatic and soil conditions in the jute growing provinces and have proved to be superior to D154, the improved strain of the Government of West Bengal. The strain C39-212, a new capsularis strain produces fibres slightly more than the said standard variety. Another strain C41-13 is a late maturing type like D154 but yields fibre nearly 2 mds. more per acre. The third strain C42-Kj-321 is an early maturing type of capsularis, a high yielder like D154, produces fibres of excellent quality and is suitable for low land especially for double cropping with paddy. A fourth strain has recently been evolved which is highly resistant to disease and pests, perfectly non-branching.

The three new olitorius strains evolved have an yield on an average of 3 mds. of fibre per acre more. In spinning tests carried out at the Technological Research Laboratories of the Indian Central Jute Committee all the three improved olitorius strains are found to be 10% better than C.G. in quality ratio.

It has been found as a result of four years experiments that the yield can be increased by more than 20% by judicious application of fertilizers and the incidence of disease can also be reduced to a great extent.

Various experiments on rotation of other crops with jute have been carried out with interesting results.

Control of disease and pests of jute: In addition to the fundamental research work on the life history of the various fungi and insect pests of jute that cause diseases and pests to jute, various effective control measures for checking those diseases and pests of jute have been evolved and demonstrated to the cultivators in their plots on a large scale. These constitute treatment of diseased seeds by disinfectants, so that the plants grown from them may be disease free, spraying and dusting of suitable fungicides and insecticides to check diseases and pests and subsequent infection therefrom and introduction of disease and pest resistant strains. Trials on a pilot-plant scale were also being carried out under grower's conditions for two years at Tarakeswar, in the district of Hooghly. It has been found that the yield of fibre in the treated fields is higher than in the untreated plots.

Soil and Retting Study: Prevailing retting methods have been surveyed and cause of coloration of jute fibre ascertained. Definite recommendations as to the improved methods of retting have been made to the cultivators.

To assess the requirements of jute crop detailed chemical examination of soil and plants has been in progress. Some specific bacteria and fungi responsible for retting jute have been isolated. It is expected that by this work the retting of jute can be improved to a great extent thereby also improving the quality of fibre.

Anatomical Studies: The formation of the fibre in the plant has been studied in different stages of the development of the crop. Work on the structure of the fibre in relation to the quality with tested samples of fibre as well as of the fibres from living plants has been carried out and very interesting results obtained. The effect of maturity on the length, breadth and lumen of ultimate cells has been studied in all the different types of jute.

Cytogenetics of Jute

An important field of work of the Jute Agricultural Research Institute concerns the breeding of high yielding types which combines superior quality of fibre. *Corchorus olitorius* is superior to *Corchorus capsularis* with regard to quality and yield. The former grows only on high lands while the latter thrives on both high and low-lying areas. Efforts to make a cross between the two have so far failed on account of a strong incompatibility barrier. A proper assessment of the basis of this incompatibility is a problem of great magnitude and is now being tackled. Work on the induction of polyploidy by colchicine and other carcinogens is also being carried out.

Physiological Investigations

Investigations on the physiology of jute seeds, root system in the different species of jute, growth in the different species and varieties of jute, with reference to moisture contents, fibre growth and wood formation during the life cycle of the plant are being carried out. It has been found that the weight of the bark exceeded that of wood in the vegetative stage, bud stage and flower stage, while in pod stage the weight of the wood exceeded that of the bark, the ratio being differently maintained on the stem according to the stage and height of the plant. It has been also found that both capsularis (D154) and olitorius (C.G.) behaved similarly, in a general way, with specific differences.

New Jute Agricultural Research Institute

As a result of partition, the Committee's Jute Agricultural Research Laboratories located at Dacca, were completely disorganized. All the improved strains of seeds evolved as a result of eight years' hard labour and investigations, records containing important experimental data, rare and costly apparatus and equipment, experiments that were in progress and were nearly in completion, were lost and abandoned. A new Jute Agricultural Research Institute was started in a rented house at Hooghly, West Bengal with a 50 acre farm at Chinsurah provided by the West Bengal Government. The entire organization and research works had to start afresh.

At present the Jute Agricultural Research Institute has got the following sections :—Agronomical, Botanical, Anatomical, Cytogenetical, Physiological, Mycological, Entomological, Chemical and Statistical. In addition to these, a Substitute Fibre Section has been started where research work on important fibres which are considered to be suitable substitute for jute are also being carried out.

The Government of West Bengal has kindly given to the Indian Central Jute Committee an area of 100 acres of land near Barrackpore for the development of a permanent Central Jute Agricultural Research Institute. The work in connection with the construction of Institute building and staff quarters will be started very soon.

Central Livestock Research *cum* Breeding Station —Haringhata

THE Central Livestock Research-cum-Breeding Station, Haringhata, has had a mixed parentage. It was conceived and sanctioned by the undivided Bengal as a post-war developmental measure. The work of its establishment started in 1945. But before much real progress could be made came the partition. The area selected for the station falling in Nadia, initially it went to East Bengal. But, subsequently, under the Radcliff Award, it was awarded to West Bengal. The Government of West Bengal had thus to assume the parenthood of the station, which was still in its embryonic state. They have nurtured it to its present form, modifying the original scheme in this process, to suit the changed needs of the new State as far as possible.

Location of the Station: The station falls in the Haringhata thana of Nadia district and is at a distance of nearly 33 miles from Calcutta. It is directly approachable by two metalled roads: one, the Calcutta-Ranaghat road, passes by its eastern boundary; while the second, the Barrackpore Grand Trunk leading to the Kanchrapara-Haringhata road, passes by its southern boundary. The road journey by car takes about an hour and a quarter. The station can also be reached by train, Kanchrapara which is 6 miles away being the nearest railway station. Buses leaving Kanchrapara every half-an-hour go past the southern boundary of the Haringhata Station.

Aims of the Station: As the name of the station denotes, its primary aims are to tackle the various livestock problems met with in West Bengal and to breed quality livestock—cattle, poultry and goats, to improve the livestock wealth of the State.

Improving milk supply of Calcutta: It is too well known that the milk supply of Calcutta is far from satisfactory. The supply is deficient both quantitatively and qualitatively and the price is exhorbitant. This is because the bulk of supply is derived from the city stables, where animals are maintained under unnatural conditions. It is generally accepted now that, to improve the milk supply of the Metropolis, the city stables must be abolished and the milch animals resettled in rural colonies to be specially set up for this purpose, milk produced at such colonies being centrally handled for processing and marketing by an efficient agency. The aim is to set up the first such "milk colony" in conjunction with the Haringhata Scheme.

Set up of the station: To serve the foregoing aims the Station is to have an efficient research organization, large herds of cattle and goats, a large flock of poultry, a modern dairy plant, and a large farm provided with means of perennial irrigation, to raise the feed required for maintaining the large numbers of livestock and to provide the land required for various kinds of agronomic experiments. Over and above, it is to have a State supervised but privately run, milk colony. Admittedly, this is rather a unique combination of activities equalled by few other institutions.

Progress made: The entire area approximating 2,500 acres of land has been acquired and almost all the buildings, residential and non-residential, except the laboratory block, have been constructed and are in use. The vastness of the area and the local scarcity of labour made it necessary to employ mechanical means to cultivate the land. The farm is, therefore, almost completely mechanized. This has provided valuable experience regarding mechanized mixed farming, as practised through a State agency.

The Station provides housing arrangement for nearly 2,000 heads of cattle in modern cattle sheds which will compare favourably with those obtaining at some of the best dairy farms of the world. The present herd consists of 350 milch animals which are producing some 35 maunds of milk daily and 700 young stock.

The poultry unit has accommodation for some 25,000 improved poultry.

Utility flocks of W.L. & R.I.R. breeds are being maintained, the eggs and progeny of which are in great demand from the public. Hatching is done artificially with an electrically operated mammoth incubator capable of hatching 4,224 eggs per month. Brooding too is done artificially with the aid of electric brooders.

The Station possesses a dairy unit capable of processing and storing nearly 500 maunds of milk daily. It is equipped with modern pasteurizing machinery of both H.T.S.T. and Holder types, a mechanical can washer, automatic bottle washing, filling and capping machines and a large cold storage unit. The entire process of conveying of milk from one section to the other and its pasteurization and bottling is automatic, milk remaining untouched by hand. The entire production is transported by road in insulated vans for supply to Calcutta.

Research work: Even though the research laboratory has not yet been constructed, work concerning several local problems is in hand. The subjects under study are scope and economics of mechanized mixed farming manurial requirements of crops, selection and breeding of fodder crops and grasses, how to produce milk and rear calves most economically, artificial brooding of poultry, physiology of reproduction, and farm costing, including cost of production of crops, milk and eggs, cost of rearing livestock and cost of processing and marketing of milk in case of a modern milk plant. The farm costing studies are also being conducted in the case of selected cultivators.

Future plans: Plans are now complete for the establishment of the first rural milk colony in conjunction with the Haringhata Farm. The actual work of construction of buildings, it is hoped, will start in 1952-53.

It is also intended to locate the State Agricultural College and Research Institute (now at Tollygunge) at the Haringhata Station.

Adjoining the area of the Haringhata Station, lands have been acquired by the Calcutta University for its field station for ionospheric research and by the River Research Institute, West Bengal. The Government of India too are contemplating setting up their overseas broadcasting station in that area. It is hoped that before long the Haringhata Station will have several scientific institutions in its vicinity.

Central Inland Fisheries Research Station

ABOUT 16 miles north of the busy city of Calcutta, stands in calm and picturesque surroundings on the left bank of the Hooghly, the Central Inland Fisheries Research Station, located near the Manirampore Gate of the Pulta Water Works. Pending the construction of permanent buildings, the Station is housed in a neat block of renovated military hutments which serve as laboratory, library, office and dormitories, ample enough though looking simple amidst the rural landscape, fully justifying the appelation of 'Matsyashramam'.

Investigations in various fields of inland fishery developments are in progress and the work covers a variety of subjects, such as fish seed procurement and transport; nursery management; aquatic manuring; weed control; predators and rivals and their elimination, parasites; diseases and mortality; life history; food; growth; planktology; water pollution; systematics; ecology; crop composition and variation; migration; fishing technique and statistics. Some of the research findings already obtained on these are of practical value of far-reaching importance.

The Station also arranges the supply of good quality of fish seed to deficit States, and during 1951 over 30,00,000 of major carp seeds were successfully distributed to Madhya Pradesh, Bombay, Hyderabad, Madras, Bhopal and Assam.

In addition to conducting researches on inland fish and fisheries as indicated above, an All-India Fishery Training Course of ten months, generally for graduates in zoology, is also conducted at the Station, the candidate being trained in the theory and practice of inland fishery work to befit them as executive officers in the State or private fisheries.

The technical work of the Station is conducted under four sections, each with its complement of officers and assistants. These four sections are estuarine; pond culture; riverine and lecustrine; and training. Besides the Chief Research Officer, who is in charge of the Station, there are three Class I Officers, five Class II Officers and twelve technical Assistants. Though the Headquarters of the Station is in West Bengal, the work extends beyond to the neighbouring States. That of the pond culture section is mainly centered at Cuttack in Orissa, where there is a field laboratory with a set of 71 experimental ponds, while the activities of the other sections also extend to the Chilka Lake, Hirakud Dam and other areas in Orissa and to the Ganga and the Damodar Valley waters in Bihar, etc.

Started in 1947 at the most critical time of the post-partition period with only part of the originally recommended complement of staff, the Station has, despite its modest beginning and the various handicaps and difficulties which had to be faced in its initial stages, already been able within the short period of its existence to establish for itself a place in the map of fisheries science not only nationally but also internationally, and the work in progress at the Station is expected to yield steadily progressive results of value for the fuller exploitation of the inland fishery resources of India.

Fisheries in West Bengal—Development & Exploitation with special reference to Deep Sea Fishing

THE area which was constituted as the State of West Bengal after partition in 1947 was never self-sufficient in respect of its fish supply. Even before partition, Calcutta, the main consuming centre of this State, was seldom in a position to arrange for more than 50% of the normal requirements of fish for its large population. Since partition, over 60% of the really productive areas of fish supplies have been lost to West Bengal, while due to the negligence of the owners of the inland water areas almost 70 to 80% of the really productive fisheries have become derelict. As a result, the State as a whole had to face a very critical position with regard to fish supplies. While all possible attempts are being made to increase production from various types of inland water areas in the State and to arrange for import of fish from all likely sources, the supply position of fish in Calcutta is today much more serious than it ever has been in its history. In addition to the factors referred to above, the great increase in the population of greater Calcutta as a result of industrialization and the migration of a very large number of refugees from East Pakistan has seriously aggravated the position.

In spite of all possible efforts that are being made to increase supplies of fish from inland water areas, it would be too much to expect that increased supply from these sources would to any extent bridge the large gap between demand and supply. Amongst the measures taken by the Government of West Bengal for increasing fish supply may be mentioned the development of the 'Beel Fisheries' which were previously a very important source of fish supply for the area. Development of most of these derelict water areas is now being taken up as a part of a Beel Fisheries Developmeent Scheme. For developing Tank Fisheries by intensive piscicultural operations nursery units were started in various districts during the year 1950-51, and roughly 86,00,000 of fry were stocked in tanks of an area of about 3,000 acres with financial and technical assistance provided by the State Government. A much larger number of tanks are being developed under the scheme during 1951-52. For helping the backward fishermen, the State Government has launched a scheme for supplying them with boats, nets and other capital goods at subsidized rates.

For tapping the rich marine resources in the Bay of Bengal, Government of West Bengal launched an experimental project in December 1950 with two fully equipped modern trawlers with trained personnel to carry out exploratory work for discovering the best fishing grounds, determining fishing seasons and assessing the suitability of various types of equipment for carrying out fishing in these waters. These vessels are also being used for training the technical personnel required for power fishing vessels and gear. During the short period of about 10 months, these trawlers have discovered a very valuable source along the south-west coast of the Bay of Bengal from the Sandheads to a little beyond the Chilka Lake. In addition to survey and exploratory work these vessels were able to bring some 6,000 maunds of high quality edible fish. If the experiment is successful, it is proposed to arrange for a larger fleet of such vessels for obtaining increased supplies of fish from this hitherto neglected source.

4. ENGINEERING & TECHNOLOGICAL

Engineering and Technological Education and Research

IMMEDIATELY after the attainment of independence, the attention of the Central Government was attracted towards the task of finding out ways and means to make the country self-sufficient in respect of technical and scientific man-power which was so very necessary for the planned expansion of Indian industry. It was felt that the calls of reconstruction in Europe and elsewhere and the enormous industrial and Government undertakings contemplated in Europe and the U.S.A. to provide full employment would make it difficult, if not impossible, to secure from abroad the services of right type of engineers and technologists to execute India's post-war development projects.

In order to meet this problem squarely, the Central Government set up (*i*) a Council in 1946 known as the All India Council for Technical Education, (*ii*) a Committee in 1946 which came to be known later on as the Sarkar Committee, and (*iii*) the Scientific Man-power Committee in 1947, with the object of co-ordinating the recommendations of these various bodies for the growth of technical education and improvement in its standards. The functions of these three bodies were directed towards preparation of a survey in the field of technical education and drawing up of plans for increasing technical and scientific man-power either by augmenting existing facilities or by creation of new facilities to meet the post-war industrial needs.

On examination of the recommendations of the Council and the Committees, one fact was broadly perceived that most of the institutions suffered from such handicaps as lack of equipment or adequate staff or adequate accommodation or of all the three. In the case of well established institutions, the intake of students had been increased without corresponding expansion of necessary facilities. The new institutions had on the other hand given effect to their development plans with inadequate funds. This obviously affected adversely the standard of education. The Government felt that the first approach to the problem of development of engineering and technological education should be to strengthen the existing facilities in the institutions so as to meet adequately the requirements for the intake, which then existed and to bring up the standard of training to the desired level. Technological education had not kept pace with engineering education and showed only limited development both in the range of subjects covered and in the number of institutions providing such courses.

It was further observed that facilities were almost non-existent then for post-graduate education and research in engineering and technology. On this question, the Scientific Man-power Committee observed as follows:—

> "These institutions have developed for teaching and the academic atmosphere prevailing therein is anything but conducive to research. The teaching staff are heavily burdened with teaching work and are left with little time for research. The equipment and other facilities available for research arre very poor

> and there is little collaboration and contact between Industry and the Institutions. Besides there are no research scholarships for fellowship worth mentioning in any of these institutions. Unless these handicaps arre removed, no real impetus can be given to engineering and industrial research."

On the question of specialized engineering courses to meet increasing industrial and Government demands, the Committee was of the view that all first grade engineering colleges should be reoriented in such a way that each institution provides for one or more specialized courses, but under no circumstances two institutions in the same zone or area overlap or duplicate in this regard. Diversity of training is to be governed chiefly by the need for it and the resources with which to carry it out.

These revelations of stark facts not only aroused the interests of the authorities concerned but the Central Government resolved to lend a helping hand for the promotion and consolidation of technical education in order that the educational and research facilities improve both in quality and quantity. The Central Government accepted a five year financial liability, both recurring and non-recurring, for 14 institutions throughout India after examining their respective development plans. A large number of research scholarships as well as industrial stipends were instituted in most of the institutions to give that impetus which heretofore lacked amongst students. By an arrangement made with the late Ministry of Industry and Supply, a large portion of machinery and scientific equipment reported surplus after the end of the World War II was released to almost all institutions at a concessional rate. Large grants were also given to some institutions who had their plans ready for starting specialized courses in engineering and technology. These and many similar measures taken by the Central Government to improve the standard of technical education as well as to accelerate the increase per year of qualified engineers and technologists have definitely contributed towards achievement of the desired results, during the preceding four years.

Engineering and technological institutions in the Eastern Region may be divided into two broad categories, *viz.*:

(A) Institutions catering for post-graduate education and research,

(B) Institutions catering for higher education in engineering and technology upto degree standard or its equivalent.

Besides the above there are institutions catering for education and training up to diploma or licentiate standard.

The following statement shows the courses of study offered in each institution, the latest admission in each course and average annual out-turn of personnel:

			Anticipated		
Institution	Subjects	Latest intake	Out-turn in 1951-52	Out-turn in 1947	Remarks
(A) (1) University of Calcutta					
(a) Dept. of Applied Physics	Applied physics	40	36	18	

Institution	Subjects	Latest intake	Anticipated Out-turn in 1951-52	Out-turn in 1947	Remarks
(*b*) Dept. of Applied Chemistry	(*i*) Applied chemistry	36	33	10	
	(*ii*) Soap technology	20	18	—	
(*c*) Dept. of Radio Physics and Electronics	Radio physics & electronics	20	18	—	
(2) Indian Institute of Technology, Kharagpur	(*i*) Mechanical handling	50	40	—	
	(*ii*) Production technology	30	26	—	
	(*iii*) Electrical communication engineering	12	—	—	
	(*iv*) Transport engineering	15	15	—	
	(*v*) Fuel technology and combustion engineering	8	8	—	
	(*vi*) Applied geology, geophysics and soil mechanics	15	—	—	
	(*vii*) Farm power & machinery	10	—	—	
	(*viii*) Soil and water conservation	10	—	—	
	(*ix*) Business management, industrial administration & industrial engineering	20	15	—	
(3) College of Engineering and Technology, Jadavpur	Engineering geology	20	18	—	
(4) Bengal Engineering College	Diploma in town & regional planning	15	12	—	
		321	239	37	
(B). (*i*) Indian Institute of Technology, Kharagpur	Civil engineering	60*	—	—	*In the year 1955-56 and onwards the number of undergraduates in the Eastern Region will be four times the number in 1947.
	Mechanical engineering	60*	—	—	
	Electrical engineering	60*	—	—	
	Building construction	30*	—	—	
(*ii*) Bengal Engineering College	Civil engineering	60	50	36	
	Mechanical engineering	20	18	10	
	Electrical engineering	20	18	8	
	Metallurgical engineering	20	16	13	
	Architecture	20	15	—	

			Anticipated		
Institution	Subjects	Latest intake	Out-turn in 1951-52	Out-turn in 1947	Remarks
(*iii*) College of Engineering and Technology, Jadavpur	Chemical engineering	60	54	17	
	Mechanical engineering	80	72	42	
	Electrical engineering	60	54		
(*iv*) Bihar College of Engineering, Patna	Civil engineering	60	54	25	
(*v*) College of Mechanical and Electrical Engineering, Sindri	Mechanical engineering	60	52	—	
	Electrical engineering	60	52	—	
(*vi*) Institute of Jute Technology, Calcutta	Jute technology	30	28	—	
(*vii*) Hindustan Charity Trust	Mechanical engineering	60*	—	—	
	Electrical engineering	60*	—	—	
(*viii*) Indian school of Mines and Applied Geology	Mining	30	20	20	
	Applied Geology	10*	—	..	
		920	503	171	

From the above statements, it is clear that not only there is an increase in the out-turn of each institution but the field of higher and post-graduate education and research work has widened embracing a variety of subjects of interest to the Industry. It will be worth knowing the stage at which we stand in this respect at present. Let us, therefore, first proceed with post-graduate education and research work. The three technological departments of the Calcutta University share fairly a large burden of this type of work.

Department of Applied Physics of the Calcutta University

History: With the object of bridging the gap between pure physics and professional engineering and in an effort to train technical personnel for Industry, a post-graduate course in applied physics was first introduced in the Calcutta University in 1925 with training facilities adequate for six students only. In 1934, the subject of electrical communication engineering was added to this course. In 1938, with the addition of some more accommodation to house the laboratories and workshop, the admission figure was raised to 20 and to avoid rush for seats, the admission qualification was restricted to graduates with honours in physics or mathematics. In 1947, the Central Government, acting on the advice of an expert committee who visited the Department and made suitable recommendations, agreed to pay a capital grant of Rs. 4.63 lakhs and a recurring grant of Rs. 50,000 for development of the Department. This was intended for construction of additional accommodation for workshop, library, and laboratory and for provision of special equipment to enable introduction of new elective subjects. Additional staff was recruited to cope with increased work due to in-take having been fixed by the Central Government at 40, including 12 seats for students from States other than the State of West Bengal. From the present session a three years' post-graduate course leading to M.Sc.(Tech.) degree under the newly created Faculty of Technology has been initiated. Upto sixteen post-M.Sc. students can be accepted at present in different research sections of the Department.

Post-graduate work: The three year course includes lectures, laboratory work and tutorials for two years in (1) machine tools, (2) applied mechanics and hydraulics, (3) applied heat and thermo-dynamics, (4) applied optics, (5) electro-technology, (6) industrial administration, (7) industrial economics and (8) engineering mathematics, drawing and surveying. The third year is left for specialization either in (1) electrical measurement and instrument technology, or (2) electrical machines and power supply technology, or (3) optical engineering and illumination technology, or (4) refrigeration engineering and air conditioning, or (5) engiecring materials and machine design.

Research activities: This is confined at present to (*a*) electrical insulating materials, (*b*) designing scientific instruments, (*c*) design of electrical machines, (*d*) design of power supply systems, (*e*) thermal properties of indigenous building materials, (*f*) applied optics and spectroscopy, and (*g*) mechanics of materials. Results of investigations carried out by the staff and research students have been published in technical and scientific journals. In addition, following research schemes have so far been worked:

(1)	Design of scientific instruments	for Bengal Industrial Research Board, and Council of Scientific and Industrial Research;
(2)	Electrical moisture meter for determining the moisture content of jute fibres of different origin and also for ascertaining their electrical properties	for Indian Jute Mills Association;
(3)	Examination of Indian muscovite mica as insulants in electrical industries	for Geological Survey of India;
(4)	Spectroscopic investigations to ascertain the cause of under-developed and stunted growth of paddy crops	for Government of Burma, (Agricultural Dept.).

Department of Applied Chemistry of the Calcutta University

History: Teaching in Applied Chemistry first began in 1920, under the Board of Higher Studies in Chemistry with a student body of ten. The University Re-organization Committee in 1934 recommended a Board of Higher Studies in Applied Chemistry and thus caused an independent Department of Applied Chemistry to be created from that year. During these 16 years, the in-take of students increased, more space for the Department was added and the syllabus underwent a revision. This Department came into lime light in 1939 with the outbreak of World War II. Due to stoppage of imports of various industrial and essential commodities, the Government as well as the industry approached the Department with grants for doing research work on several problems they were faced with. Large donations came in with the requests to start special courses of studies in plastics and soap technology.

In 1947 the Central Government consented to give following capital and recurring grants to this Department subject to certain conditions: Rs. 4,25,000—Buildings, Rs. 2,82,000—Equipment, and Rs. 1,20,000—Recurring expenses. With the above grants partly in hand, it has been possible to add large floor area for various laboratories, to buy special equipment for starting different elective subjects, to increase the number of teaching staff and lastly to increase in-take of students to 36, including 12 students from Bihar, Assam, Orissa, Travancore, East Punjab, etc. as required under conditions governing Central Government grants.

Post-graduate work: Subjects of studies for a two year post-graduate course leading to M.Sc.(Tech.) degree are—(1) chemical technology, (2) chemical engineering, (3) Elective from—(*a*) applied bio-chemistry, (*b*) silicate industries, (*c*) oil technology, (*d*) pharmaceuticals, (*e*) plastics, and (*f*) advanced chemical engineering. This course is now open to graduates in science with honours in chemistry. About 400 students have passed out of the Department since the inception of the course.

With the creation of a Faculty of Technology, the course will now be of 3 years' duration with special subjects mentioned in (3) above to be taken in the third year of the course. The first two years will be devoted to general subjects of chemical technology, chemical engineering and fundamental chemistry.

Research activities: More than 300 research papers have so far been published by the staff and research students. Important research work that received recognition has been done in the following subjects: low temperature carbonization of coal, high pressure electrolysis, nutritive value of foodstuffs, enzymes from snake venoms, viscose and cellulose acetate, oil plastics, hydrolysis of fats, durability of glass, chemical and biochemical utilization of molasses, biochemical retting of jute, organo-arsenic and antimonial drugs, rancidity of fats, sweating of soaps, jute plastics, and shark liver oil.

Department of Radio Physics and Electronics of the Calcutta University

History: In the University of Calcutta the teaching of wireless as an elective subject was introduced in the syllabus of the Master's degree in pure physics in 1925 and a separate section was created for this purpose. Steps were also taken at the same time to make research an integral part of the activities of this section. A similar section aiming at research and teaching in radio communication was added to the Applied Physics Department in 1935. In 1945 realizing that it was not possible to keep the increasing field of radio within the limited scope of an elective subject, a special two years' course in radio physics and electronics leading to the Master's degree was instituted. Simultaneously with this decision came the wind-fall in the form of a Central Government grant for expanding and strengthening the technological departments of the Calcutta University. The expert committee set up by the Central Government also supported the institution of a separate department for radio physics and electronics. Central Government agreed to give Rs. 3,40,000 for buildings, Rs. 2,10,000 for equipment and a recurring grant of Rs. 49,000 for meeting the recurring expenditure of the Department. The first batch of students under the new decision was admitted in 1949 after the revised syllabus was approved by the Calcutta University in 1948.

Post-graduate work: The old two year course has now been replaced by a three years' course leading to the M.Sc.(Tech.) degree. The new syllabus has been so modelled as to impart not only a thorough knowledge of the technological aspects of the subject, but also that of basic physics and mathematics which are essential for proper understanding of the subject. The number of students to be admitted every year to this course is 20 including 6 seats which are reserved for students from States other than the State of West Bengal.

Research activities: The upper atmosphere in general and the ionosphere in particular had been the main subject of investigation. The programme of research had twofold objectives: firstly, routine observations of the ionospheric conditions and prediction of the maximum usable frequencies, and secondly, fundamental investigations. Data collected in this Laboratory proved to be of great help to allied military operations in the Far East. Routine observation service has been strengthened by financial help which the laboratory is receiving from the Council of Scientific and Industrial Research, Government of India, since 1943. Of the important contributions made to the fundamental knowledge of the upper atmosphere, special mention may be made of the following:

> " Discovery of ionospheric layers at low heights, propagation of electromagnetic waves through the lower ionosphere, distribution of gases in the upper atmosphere, stratification of the ionosphere, effect of meteoric showers on ionospheric ionization, effect of solar eclipse and sunspot on the ionosphere, geomagnetic control of ionospheric ionization, theories of origin of the night air-glow and auroral spectra and tides in the ionosphere."

In recognition of the important work done here, the Commonwealth Scientific and Industrial Research Organization of the Commonwealth of Australia has presented the Department with a complete modern automatic ionospheric recorder.

Apart from ionospheric research, important work on voltage stabilizing circuit, thermionic valves, field strength survey, microphones, loudspeaker, active nitrogen, discharge tubes, dielectric constant measurement at high frequency has also been carried out.

The main subject of research in the Radio Communication Laboratory had been on atmospherics—their seasonal and diurnal variations particularly during the monsoon months. Apart from this, work on filter theory, development of R.C. coupled r.f. and a.f. oscillator and its application to the generation of wide band frequency modulated signals deserve special mention.

Present programme of research: Researches on the ionosphere still forms the main item of activity. These include systematic studies of F-layer ionization, tides in the ionosphere, D—layer, sporadic E, effect of meteors and thunderstorm on ionospheric ionization and distributions of atomic oxygen, atomic nitrogen and sodium in the upper atmosphere. Works are also in progress on the development of an entirely new technique for investigating the ionosphere. It is expected that the new method will enable one to make the study of the finer structural details of the ionosphere. Plans have now been finalized for establishing a permanent ionosphere field station outside the city area. For this purpose the Government of West Bengal have made available a plot of land measuring 450 bighas at Haringhata (about 37 miles north-east of Calcutta) and the Council of Scientific and Industrial Research, Government of India, a capital grant of Rs. 84,000/-.

Other items on the programme of research include aerial matching, experiments on nuclear moments, mechanism of production of the light effect in ozonizer and development and repairs of thermionic valves. Steps are also being taken to begin work on television.

Indian Institute of Technology, Kharagpur

History: This Institute owes its origin to the recommendations of a Committee of Industrialists and Educationists known as the "Sarkar Committee" which met in 1946 to survey facilities for technical education and to recommand steps to be taken by the Government to ensure an adequate supply of technical personnel for post-war industrial development. The Central Government accepted the Committee's recommendations and sanctioned the scheme for establishment of the Institute at Kharagpur for training about 1320 students in under-graduate courses in engineering and technology and for imparting to about 400 students advanced post-graduate instruction in selected subjects, which were non-existent heretofore. The site of the Institute which is within easy reach of the industrial town of Jamshedpur and the great city of Calcutta, came as a gift from the State Government of West Bengal.

The Institute is fortunate in securing the services of several professors of high standing from Europe, who have contributed a good deal to the promotion of technical education.

The Government have released a large number of machine tools which have been installed in the Workshop for the training of all types of engineers at under-graduate and post-graduate levels. These machines offer best facilities for training in manufacture of commercial articles.

A number of Advisory Committees were set up with men of repute in Industry, Commerce and Education to advise the Director of the Institute on the feasibility of starting such post-graduate courses as are mentioned in the original plan. Before instituting these courses, it was found necessary to survey the needs of Industry during next 5—10 years and their capacity to absorb our graduates. A very great deal of thought has gone into the discussion of the course, their importance and value. It has been decided to embark this year on a very limited activity so that every advance may be the result of very careful investigation and thought.

The Institute aims at teaching the principles and the theories of the many applied sciences with practical and industrial aspects in such proportion as to lay more emphasis on practical training and industrial values. The great majority of students receiving training in this Institute will not only have a strong foundation of theory, but first hand knowledge and experience of the actual processes of industry, of the practices in workshop and factory, of the behaviour of machines and tools and of the nature of materials and of the changes which they undergo under the impact of the forces at the command of an engineer and a technologist.

In our struggle for industrial development we require men who have not only the knowledge of the fundamental basis of applied science, but also the know-how of processes as applied to industrial operations. The Indian Institute of Technology will attach the greatest importance to the acquisition of this "industrial know—how" in the under-graduate course. The Institute will also offer facilities to graduates of universities and technical institutes to take up investigation of problems of industry and to carry out research in the numerous problems of technology. The Institute thus will become a centre for higher thought of technology in the country.

Post-graduate work: Based on the recommendations of the various Advisory Committees of experts, the Institute will start its post-graduate activity with the following courses:

COURSE	NO. OF STUDENTS	DURATION	ADMISSION QUALIFICATION
1. Mechanical handling	50	12 months	A degree in mechanical, electrical or mining engineering
2. Production technology	30	18 months	A degree in mechanical engineering
3. Electrical communication engineering	12	3 years	(1) Science graduates with honours in physics or mathematics (2) Graduates having a degree in communication engineering or equivalent
4. Transport engineering (roads)	15	12 months	A degree in mechanical engineering
5. Fuel technology and combustion engineering	8	18 months	A degree in chemical and mechanical engineering
6. Applied geology, geophysics and soil mechanics	15	2 years	A degree in applied geology, geophysics and soil mechanics from the I.I.T. or equivalent

Research activities: (1) *Department of Mathematics*: Research work is in progress on the following problems: (*a*) Finite deformation; (*b*) Elastic—Plastic problems; (*c*) Approximate methods for bending and vibration of elastic plates; (*d*) Synthetic method for non-linear engineering problems; (*e*) Non-homogeneous solutions of the wave equation; (*f*) Generalized singular points with applications to fluid flow; (*g*) Electron-optics; (*h*) Boundary layer and turbulent flow over an infinite plate; and (*i*) Problems arising out of Einstein's recent field theories.

(2) *Department of Electrical Engineering* (*Communications*): Theoretical research work has been done on feedback amplifiers generally spoken in servo-mechanism systems. Following problems are now receiving attention: (*a*) Transient phenomena in lines with variable inductances and capacitances; (*b*) Problems in network theory which are applicable to microwave devices and carrier frequency systems; (*c*) High power ultrasound oscillators; (*d*) Analyzing sound produced by insects especially mosquitoes; and (*e*) Stability problems in feedback amplifiers.

(3) *Department of Mechanical Engineering*: Research work under this Department has been carried on, among others, in applied mechanics, structural analysis, theory of machines and internal combustion engines.

New methods have been found for systematical construction of statically determinate and indeterminate frames (disc and rod frames) in plane and in space. Presently this subject is being extended and results are being compiled to form a text book suitable for purposes of instruction and for further investigations in this subject.

From the many new frames found, it has become obvious that the known methods of graphic statics have been developed from a wrong basis and, therefore not applicable to statically determinate frames in general. Search for new basic principles for the graphical determination of forces has yielded important results. The new methods cover also all kinds of mechanisms, and diagrams of dynamic forces can be made with their help. Further investigations about the determination of forces are in progress.

Various rational methods of finding new mechanisms have been published by this department in two books (1) "Principles in Design of Mechanisms" and (2) "Machine Elements". A methodical search in the German Physikalische Technische Bundesanstalt for new coaxial clutches with reversed motion was checked with method developed here and a new clutch without gears has been developed which is also useful as a differential gear for motor vehicles. A model is being made presently for preliminary investigation of its running qualities.

A method has been developed to find gear trains and arrangements of clutches for given numbers of speed ratios in a systematical manner. A most compact gear box has been found for four speed motor car gears. Preliminary work has also been done in the same way about epicycloid gears. Further work is being done about the determination of degrees of efficiency and selection of economical gears. Models for testing will be made as soon as the gear shaping machine is set up in the Institute.

In gear train research investigations have been made about how many speeds can be achieved with a given number of gear wheels and one or two fixed spare pins for carrying the wheels. It has been shown that with 6 wheels 16 different speeds forming a geometrical series as required in machine tools may be obtained by exchanging the positions of the gears, which means more speeds than can be achieved by any other existing method.

With regard to the Theory of Linkages, a theory has been developed on how to determine the co-ordinates of a mechanism, how to express the values of requirements or assumptions for designing mechanisms in terms of the number of co-ordinates and how by balancing these co-ordinates against the co-ordinates of the mechanism, to find what demands could be fulfilled and what assumptions may be made in designing. Thus, instead of trials and errors, rational methods are pointed out leading to successful design and construction.

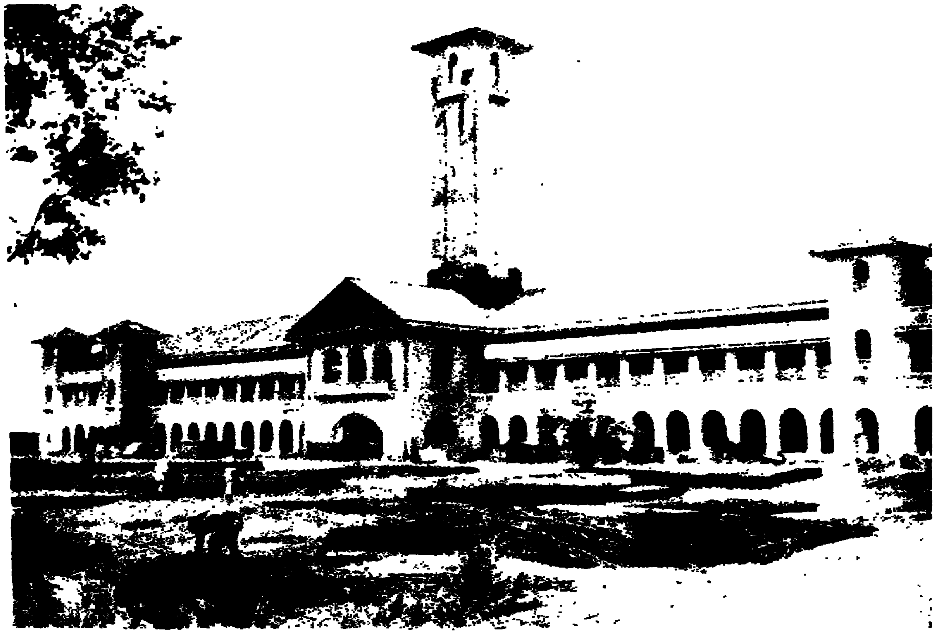
Gas dynamical problems generally resolve themselves into partial differential equations of the hyperbolic type. The case of non-uniform unsteady linear flow of gas which is important in the design of internal combustion engines can be reduced into partial differential equation of the second degree by using the Euler form of the equation of motion and the equation of continuity (the Legendre transformation becoming rather cumbersome in practical problems). The numerical method of computation developed recently by Hilda Geiringer for the solution of actual wave interaction problems is rather laborious. A graphical solution has been developed here based on the method of characteristics put forward by Prandtl and Busemann which appears simpler in application. The possibility of deriving fairly reliable solutions by such graphical computation appears to indicate a wider field of application for the method, perhaps to the case of axially symmetrical supersonic flow leading to the design of nozzles for producing a parallel jet, which is now being investigated.

(4) *Department of Applied Chemistry*: Research and development work on the gasification of coal and coke is intended to be taken in hand. For this purpose small 'producer' sets have been fabricated for study of producer-gas reaction. A small water-gas plant will supply synthesis gas for the Fischer-Tropsch reactions. In this connection a thorough and systematic work on catalysis has been undertaken or planned as follows:

(*a*) Physico-chemical properties of cobalt and iron catalysis to be used in Fischer-Tropsch slurry reactor are being studied. Viscosity-temperature relation of oil-catalyst slurries, the problem of settling and hindered sedimentation, and catalystic activity are under investigation.

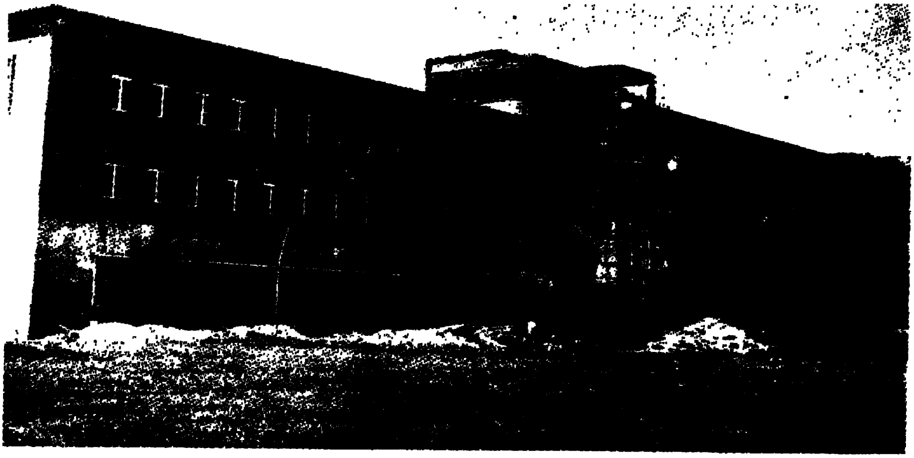
(*b*) Fundamental problem of mechanism of catalysis is being investigated by absorption studies. Studies are being continued in the fundamental problems of the absorption of individual gases by a catalyst from a gas mixture which yields, at higher temperature, on the same catalyst surface, products of technical value.

(*c*) Work is in progress on the Messrschmidt process for the production of industrial hydrogen. A catalyst prepared from an intimate mixture



INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

BENGAL ENGINEERING COLLEGE, SHOWING WATER WORKS AND THE HEATON HOSTEL IN THE BACKGROUND



BENGAL ENGINEERING COLLEGE (NEW BUILDING) of cement and haematite and rendered highly porous by air foam concrete is being studied.

(d) *High pressure laboratory*: This laboratory is being designed to carry out studies on all important problems of technical reactions at high pressure. Design and fabrication of pressure vessels, compressors, special valves and fittings have been undertaken.

(e) *Combustion laboratory*: Fundamental studies on combustion reactions including pulverized coal burning in boilers and furnaces will form an important aspect of research activities of this laboratory. Some related problems such as efficient burning of fuel and utilization of low grade coal will be studied.

The following problems are being studied:—

(*i*) The density and distribution of electrons in the valence band and upper unfilled bands can be directly studied by absorption and emission spectra in the soft x ray region; such studies carried out with different types of solids, *viz.*, ionic, molecular, metallic etc., are expected to yield valuable insight into their characteristic differences in behaviour.

(*ii*) Measurements on conductivity, photo-conductivity and thermo-electric properties of a solid together with the absorption spectrum yield important information regarding the solid type, nature of carrier and electronic processes involved in semi-conducting and rectifying properties etc.

(*iii*) Study of the luminescence spectrum under ultraviolet radiation of cathode rays together with measurements on decay and thermoluminescence, helps in understanding processes like, activation energy transfer, trapping mechanisms and energy storage, etc. Besides, such studies are of importance in connection with the development of fluorescence paints and varnishes, screens for x-rays and cathode rays, fluorescent lamps etc. which have great commercial values.

(5) *Department of Chemical Engineering*: Investigations are being carried on the solvent extraction of vegetable oils. Laboratory experiments on the suitability of a solvent under Indian conditions for extraction of Castor and Mahua seed, are over. It is now proposed to construct pilot plants with a view to studying the different aspects of the problems.

Effect of reflux ratio on plate column distillation is being studied with different binary mixtures, having widely different physical properties.

Bengal Engineering College, Sibpur

Established in 1856 as the Calcutta College of Civil Engineering, this institution is one of the oldest in India. The College was developed in 1880 into a residential institution and in the same year a degree course in civil engineering was instituted. The College is at present affiliated to the University of Calcutta for degree courses in civil, mechanical, electrical and metallurgical engineering, architecture and for a two-year post-graduate diploma course in town and regional planning.

The laboratories and workshop are well equipped for teaching and for carrying out researches in technology and science. The 'Strength of Materials' laboratory is fitted with modern testing machines for the study of tension, compression and shear upto a load of 100 tons, also of the hardness and fatigue of materials. There is a dynamic balancing machine, photo-elastic equipment and the SR-4 strain gauges. The metrology laboratory has a fine collection of precision measuring instruments. The workshops have the necessary facilities for constructing precision instruments required for advanced study and research. The soil mechanics and cement testing laboratory, the metallurgy laboratory and the geophysical laboratory are well equipped. The geophysical laboratory provides facilities for fundamental work in seismology. The Electrical Engineering Laboratory contains a high voltage testing equipment comprising a motor alternator sets feeding a high voltage transformer capable of developing 100,000 volts on the H-T side.

Research work: Estimation of the magnetomotive force on tapered bodies, the properties of fuse-breakers in relation to primary distribution systems and the effect of dielectrics in high voltage transformers are some of the problems under investigation in the Electrical Engineering Laboratory. In the Communication Laboratory, investigations are in progress for the development of the method of generating frequency-modulated oscillation through radio-frequency oscillators and for studying the properties of magnetic amplifiers with stalloy core. The problem of supercooling and other aspects of the liquid state are in progress in the Physics Laboratory. Theoretical work is also being carried out in the Department of Mathematics, on the estimation of stress-distribution in beams with circular holes, and also on the quantum mechanical analysis on the generation and multiplication of hard and soft components of cosmic ray showers. Work is in progress in Geophysics Laboratory on the design and development of electromagnetic instruments for recording feeble vibrations and also on the methods of their standardization. Theoretical work in geophysics is also in progress for study of the seismological evidence on the internal constitution of the earth and also on the modification of the dynamo theory in geomagnetism, their correlation with different properties of the ionosphere and with the world wide magnetic field variation. The Metallurgy Laboratory is engaged on the study of age-hardening phenomena, the corrosion behaviour of metals and alloys and also the behaviour of gases in metals and alloys. In the Chemical Laboratory investigations are in progress on the Fischer-Tropsch synthesis of liquid fuels, and also on the agricultural and engineering properties of the soils of West Bengal, and methods are being developed for the testing and standardization of foundry sands. In the Mechanical Engineering Laboratory investigational and development work is being carried out on the various components of gas turbine units, particularly on the compressor and the combustion chamber. Work is also being carried out on an experimental flash-steam boiler.

College of Engineering and Technology, Jadavpur

The history of establishment of the College under the auspices of the National Council of Education has been told in course of our discussion of the circumstances in which the National Council of Education came into existence.

The College offers 4 years' degree courses in electrical, mechanical and chemical engineering leading to the degree of Bachelor of Electrical Engineering, Bachelor of Mechanical Engineering and Bachelor of Chemical Engineering respectively which are awarded by the National Council of Education.

The following College laboratories have been strengthened as a result of Government grants and it is possible now to carry out post-graduate and research work in these laboratories on any subject relating to engineering and technology:

(1) Electrical Engineering Laboratory;
(2) Mechanical Engineering Laboratory;
(3) Chemical Engineering Laboratory; and
(4) Unit Operations Laboratory of Chemical Engineering.

Arrangements have also been made for the students to work in the Glass and Ceramic Research Institute which is situated near the College compound. The workshop is well equipped with representative types of machine tools and accessories for providing workshop training in carpentry, smithy, foundry, etc. The foundry and a portion of the workshop are operated on commercial lines manufacturing machine tools and other commercial products. Besides a large machine shop equipped with an over-head travelling crane and a large number of most up-to-date machine tools have recently been acquired and will provide facilities for machine tool work, electric and gas welding, etc.

Post-graduate studies: The Central Government have made available to the Institute a bulk grant of Rs. 40,000 for instituting a special course in engineering geology for engineering and geology graduates. This amount is intended for purchase of additional equipment for this special course. It is understood that this course will be instituted very shortly.

Research activities: (1) *Chemistry and Chemical Engineering*: A list of research problems that are now being attended to in the College is given below:

(*i*) Determination of processing conditions for the preservation of Indian vegetables by heat treatment (Food Technology Laboratory) with the grant from the Council of Scientific and Industrial Research;

(*ii*) Investigation in the use of preservative ice for storage and transport of fish in fresh state (Food Technology Laboratory) with the grant from the Government of West Bengal;

(*iii*) Preparation of cortisone and corticosterone analogues (Organic Chemistry Laboratory) with the grant from the Council of Scientific and Industrial Research;

(*iv*) Studies in the alkylation of unsaturated ketones (Organic Chemistry Laboratory) with grant from East Indian Pharmaceutical Works Ltd.;

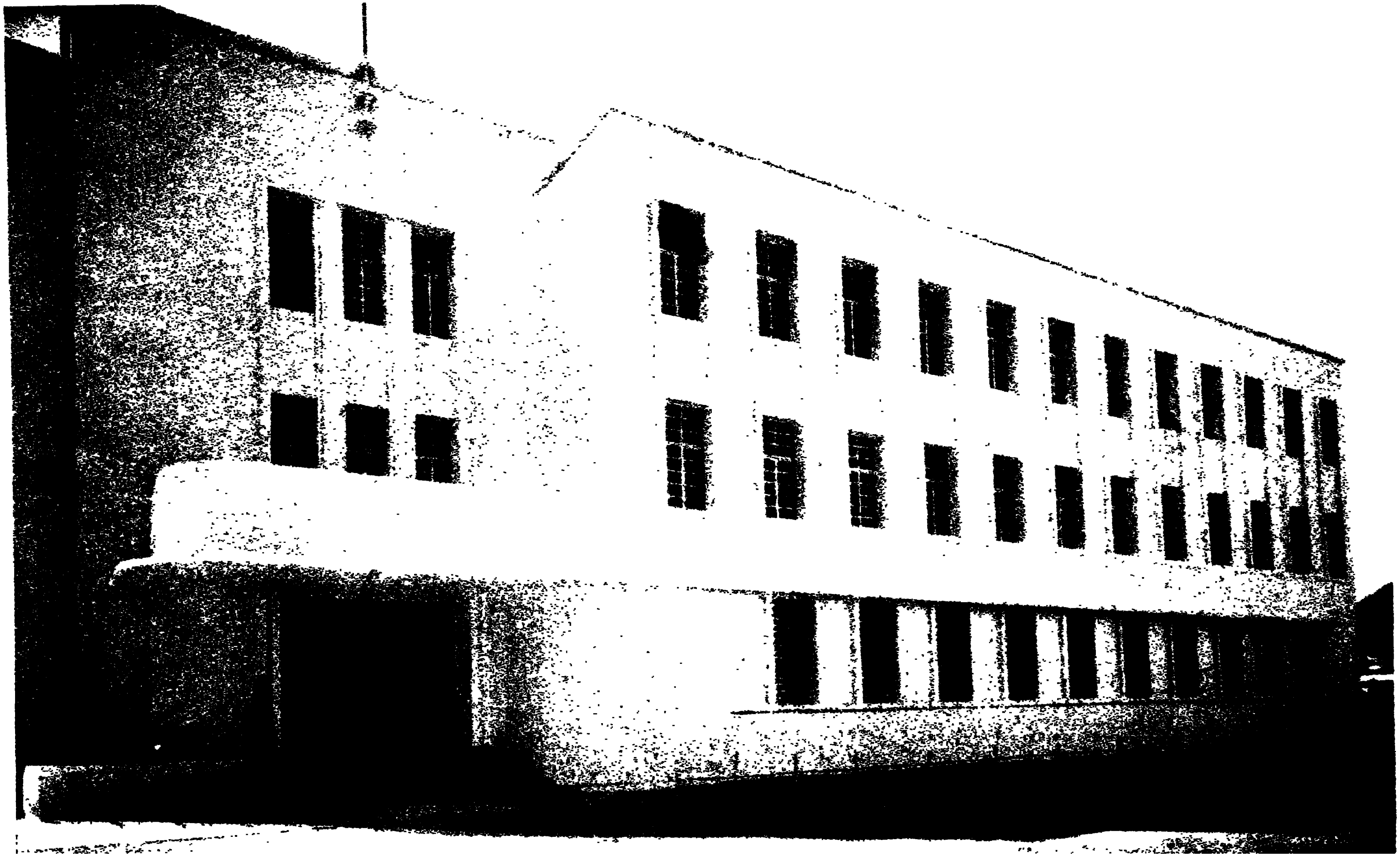
(*v*) Utilization of the organic reagent 5, 6—benzo-quinoldinic acid for the estimation and separation of elements (Inorganic Chemistry Laboratory) with grant from the Calcutta Chemical Co.; and

(*vi*) Studies of yeast nucleic acid (Physical Chemistry Laboratory) with grant from the Calcutta Chemical Co.

(2) *Applied Mathematics*: A programme of research on the colloidal instability of cloud particles at temperatures above and below the freezing point has been arranged with research grant from the Council of Scientific and Industrial Research. One of the objects of this research is to study qualitatively and also quantitatively the various technique which lead to the growth of cloud particles above and below the freezing temperatures. Two specially designed cloud chambers are being used for the purpose and some useful results have been obtained. Investigation is also being carried out on the flow pattern round bodies of various shapes (including aerofoil) maintained at various fixed temperatures both in water channel as well as air stream, with particular reference to the conditions of the 'boundary-layer' and the effect on 'lift' and 'drag'-coefficients. Other investigations with have recently been done relate to rainfall and run-off with particular reference to river forecasting in India, the nature and the causes of the disturbance produced by the great Assam earthquake of August 15, 1951, a study of electric charges on individual drops of rain and a study of the snowmelt in the Himalayas.

3. *Engineering Geology*: Investigational work has been done in the Engineering Geology Laboratory in connection with the testing of soil specimens taken in Calcutta for the project of an under-ground railway. The test of these soil samples relate to the determination of cohesion and angle of internal friction, liquid and plastic limit, proportion of water content of the soil, unconfined compressive strength mechanical analysis of soil and determination of the proportion of sand, silt and clay in various samples. From these laboratory results the French experts arrived at the conclusion that the sub-soil of Calcutta is quite suitable for the construction of an under-ground tube-railway through the city at depths ranging from 60 feet to 125 feet.

Following the partition of the country, India has lost its valuable source of rock-salt and gypsum deposits in the Salt-Range of Punjab. This necessitated investigation for finding out alternative source for salt to meet the country's demand. The State Government of West Bengal wanted to explore the possibility of manufacturing salt by the process of solar evaporation of sea water at the Contai sea beach of Midnapore. Detailed contour surveys along with aerial photographic survey have been carried out and 20 bore-holes of an average depth of 30 feet each have been dug in that region. It is now found that the best floor for the evaporation and concentration of sea water is made of clay, which is found under the sandy soil of the beach. The suitability of the clay bed at reservoir area, concentration chamber and crystallization chamber has been studied in the laboratory by testing of undisturbed samples from different bore-holes. The determination of co-efficient of permeability, porosity, water-content, the angle of internal friction and cohesion, liquid and plastic limit,



proportion and grain size of sand, silt and clay in each sample have been carried out in this laboratory. Research work on this problem is still in progress and work is now directed towards determining the saline content of the pit-brine collected from these bore-holes.

At the request of the Director, Indian Institute of Technology, Professor in charge of Geology has carried out investigation relating to water supply near Hijli-Kharagpur area which offers a very serious problem to the Institute. The area consists of a porous and semi-pervious lateritic soil which is a very bad aquifer. Wells get completely dried up in this area and the life of tube-wells is very much shortened whenever heavy pumping is resorted to. The geology of this area has, therefore, been explored by digging several bore-holes near the Institute and also away from the Institute on the alluvium which is beyond the limit of laterite. From the study of the samples so collected from the bore-holes, it appears that the lateritic covering exists upto an average depth of 60 feet and is underlain by unconsolidated sediments known as older alluvium. The sandy material of the older alluvium is the only source of tapping the underground water through the existing tube-wells. The bore-holes sunk in the newer alluvium beyond the limit of the lateritic zone, have proved the existence of a better aquifer where the existing wells are not dried up even during summer. The core samples collected at this spot indicate presence of a highly porous and pervious sediment running for about 50 feet without any break. Water can be obtained from this region in ample quantity. It is calculated that about 250 million gallons of sub-surface water can be obtained per year within one sq. mile of catchment area assuming that about 17 inches of rainfall, which is one-third of the total rainfall in that area, can penetrate into the sub-soil.

Research has also been carried out with the clay samples of the laterite for the manufacture of bricks. Sample bricks were prepared in the laboratory and showed that the clayey type is refractory in character and gets vitrified at 1250°C. Its crushing strength is 2500 lbs. per sq. inch. The sandy type is vitrified at 1120°C and its crushing strength is 1800 lbs. per sq. inch.

Institute of Jute Technology

The Institute of Jute Technology trains student apprentices for supervisory posts in the jute mills of India. The course is intended to be of 3 years' duration and about half the time is spent in practical training in the mills. The classes of the Institute in addition to covering details of spinning, weaving and finishing include instruction in background subjects such as mathematics, textile physics, chemistry, machine drawing, production and marketing of jute and business methods.

The Institute has been set up within the orbit of the University of Calcutta and trains such students as are nominated by the jute mills. The Institute is administered by a Governing Body on which both the Indian Jute Mills Association and the University of Calcutta are suitably represented. Applicants for admission to the Institute should have passed Inter-science examination with physics, chemistry and mathematics as subjects, preference being given to those who have passed the examination in first division. The Institute provides modern laboratories, lecture rooms and exhibition rooms. A technological block to house full-scale spinning and weaving machinery is being built.

The Institute is located at 35, Ballygunge Circular Road (close to the Biological Departments of the University College of Science, Calcutta University) and was formally opened on March 10, last year.

Technological Research Laboratory, Indian Central Jute Committee

The Indian Central Jute Committee was incorporated in the year 1936 the Technological Research Laboratories, under the said Committee began functioning in the autumn of 1938. The main object of the Technological Research Laboratories is to carry out research work on jute to help the jute industry towards proper growth and development by supplying all possible data that may be gathered from day to day scientific experiments on the properties and uses of jute. In post-partition years, the necessity also of finding out suitable substitutes for jute has gained ground and these laboratories are equally keen and active in experimenting upon other kinds of long fibres as on jute with a view to solving the problem of jute shortage.

Some of the subjects on which research is being carried on are:

(*i*) Assessment of quality by actual spining trials, etc. of fibre samples coming from the Committee's Agricultural Research Laboratories;
(*ii*) A study of relationship between measurable physical and chemical fibre characters and spinning quality;
(*iii*) Spinning trial assessment of quality of commercial jute samples;
(*iv*) Fundamental and background research, both chemical and physical, on the jute fibre;
(*v*) A study of spinning process;
(*vi*) New and extended uses of jute; and
(*vii*) Utilization and prevention of waste.

Some of the investigations which have borne results may be briefly mentioned as follows:

(1) A technique for spinning small (10 lb.) samples of jute (and other bast fibres) has been worked out; this has been very useful in assessing qualities of jute grown in various parts of India under Indian Central Jute Committee and provincial control.

(2) Fundamental study of jute substitutes has shown mesta (and bimli) to be the nearest approach to jute, this fibre is now widely used in Indian mills.

(3) Technological Research Laboratories are actively co-operating in the grow-more-jute campaign as well as in the development of other long fibres all over India. Useful suggestions for the best utilization of jute substitutes are being offered to the industry.

(4) The cause of colour of shamla jute (grown mostly in West Bengal) was discovered here and a simple way of removing the same without affecting the fibre suggested. This is now followed by some Calcutta mills. Due to the dark colour, shamla jute is considered inferior to Pakistan jute.

(5) The chemical nature of jute is now more clearly understood as a result of fundamental study of the fibre in T.R.L. This will go a long way in processing the fibre in various ways when the present scarcity disappears.

(6) Considerable progress has been made and a workable standard arrived at for the scientific gradation of jute fibre so that the cultivator may get the proper price for his stuff, based principally on the work done in T.R.L.

(7) Assessment of quality of various commercial varieties of jute grown in the land, by spinning trial and testing in T.R.L., has been useful to the industry in blending them properly.

(8) Work on the effect of twist factor on yarn strength has revealed that often unnecessary twist is imparted to the yarn by the mills; this not only increases the cost of production but also makes the yarn less strong.

(9) It has been shown that by chemical treatment of jute bags it is possible to delay appreciably syrup formation when sugar is stored in such bags in humid atmosphere. The purer the sugar, the better was found to be the keeping quality.

(10) Work in T.R.L. has shown that linseed fibre (now a huge waste in India) can be satisfactorily used as a jute substitute to the extent of about 75%.

More than 94 papers have so far been published in different scientific journals of this country and abroad in which the research work has been fully explained. The Committee publishes a monthly bulletin, research memoirs and series of leaflets on subjects related to jute technology.

The Indian Central Jute Committee is financed by annual grants from the Central Government. The annual expenditure of the Technological Research Laboratories amounts to Rs. 3 lakhs. It has been decided to start a Weaving Section shortly.

Technological research leaflets embodying the important findings of the Laboratories, expressed in simple terms, are issued to the jute mills through the Research Department of the Indian Jute Mills Association, Calcutta.

Research in Improving quality of Portland Cement

A passing reference may be made to the work of a practising engineer, Mr. A. K. Datta, towards improving the quality of portland cement. Portland cement during the process of setting, liberates free lime equivalent to 8 to 11 per cent of the weight of cement. This free lime is the source of weakness in set cement.

Laboratory experiments have shown that with the addition of active silica or alumina to cement, free lime is converted into stable silicates or aluminates. This definitely increases the strength and durability of cement. Due to absence of free lime in the set cement, reinforcement in concrete work is protected against rust and such concrete has proved to be impervious to water.

Brick Jhama or over-burnt fused brick, when ground to cement fineness, has pozolanic property of combining with lime in presence of water. Several tests made in the laboratory have revealed that with addition of fine powder of brick jhama, the quality of cement improved considerably. These tests led to the idea of manufacturing what is known as artificial pozolanic cement. Long elaborate experiments with portland cement and jhama have revealed encouraging results which indicate that with age tensile strength of cement with addition of jhama is greater than that of cement without such addition.

Higher Education in Engineering and Technology upto degree Standard or Equivalent

In striking contrast to post-graduate training, under-graduate education has developed extensively in this region, especially in the three basic branches of engineering—civil, mechanical and electrical. In the year 1947, there were only two colleges who were responsible for this type of education and the total in-take of graduates as recorded in the survey of the Scientific Man-power Committee was approximately 415. In addition, Indian School of Mines and Applied Geology, Dhanbad, turned out 20 graduates in mining engineering.

The position today is encouraging. In addition to the institutions referred to above, we have the Indian Institute of Technology at Kharagpur functioning from last year, under the administrative control of the Central Government with initial compliment of 210 students. The Government of Bihar have started a new college in Sindri known as the College of Mechanical and Electrical Engineering. The Institute of Jute Technology was also opened last year for training of 60 students per year in jute technology.

The progress in engineering and technological education has not only been in the direction towards increasing the number of graduates but also in creating facilities for such courses as were not in existence heretofore. New courses in agricultural engineering, naval architecture, applied geology, geophysics and soil mechanics will soon be started in the Central Government Institute at Kharagpur. A committee of road experts has been constituted to examine the necessity of starting a special course in highway engineering in this region. The degree courses in these institutions vary between 4 and 5 years, including one year's compulsory practical training in the latter case. The minimum admission qualification is Intermediate in Science with physics, chemistry and mathematics or its equivalent. Experience has, however, shown that the demand for receiving this type of education is so great that even with the

	Civil Engineering	Mechanical Engineering	Electrical Engineering	Chemical Engineering	Metallurgical Engineering	Building Construction	Agricultural Engineering	Naval Architecture	Architecture	Applied Geology Geo-physics & Soil Mechanics	Applied Geology	Mining Engineering	Jute Technology	Total in each institution
Bengal Engineering College, Sibpur ...	80	20	20	—	20	—	—	—	20	—	—	—	—	160
College of Engineering and Technology, Jadavpur	—	80	60	60	—	—	—	—	—	—	—	—	—	200
Indian Institute of Technology, Kharagpur	60	60	60	—	—	30	50	12	—	30	—	—	—	302*
Bihar College of Engineering, Patna ...	60	—	—	—	—	—	—	—	—	—	—	—	60	60
College of Mech. and Elec. Engineering, Sindri	—	60	60	—	—	—	—	—	—	—	—	—	—	120
Institute of Jute Technology, Calcutta ...	—	—	—	—	—	—	—	—	—	—	—	—	60	60
Indian School of Mines and Applied Geology, Dhanbad	—	—	—	—	—	—	—	—	—	—	10	30	—	40
Birla Engineering College, Ranchi ...	—	60	60	—	—	—	—	—	—	—	—	—	—	120
Total students in each type of course ...	200	280	260	60	20	30	50	12	20	30	10	30	60	1062

*In the year 1954-55, total admission to the first year courses in the Institute will be about 302 and the total student body of the Institu then will be 1320.

increased facilities, not all those who apply for admission are successful. In other words, admission today is restricted to those who are placed in the first division in Intermediate in Science and to a few who pass the examination in second division.

The standard, curricula and syllabuses of the various courses generally conform to the pattern of corresponding courses in the United Kingdom. There is, however, little scope for specialization in the numerous branches of engineering at the under-graduate stage. The existing system may, therefore, be regarded as relating mostly to general engineering education in the basic branches. The table on page 157 shows the marked improvement in the in-take of institutions since the introduction of various development schemes.

A step has been taken towards advancement of technical education and today we are in a better position to produce more engineers and technologists than what we were 4 years back.

India is embarking on a great industrial development and in this effort engineers and technologists have an increasing importance. It is vital that a greater proportion of the best brains of the country should embark on an industrial life. This is a scientific and industrial age and no career can be more honourable to a youth than that of developing his country's resources for the benefit of his fellow countrymen. Being conscious of this, men in education and Government have completed the first phase of their task in expanding and improving facilities for technical education. Let those who reign the Indian industry today now come forward to honour and accept the young harbingers of happiness and prosperity.

5. COMMERCIAL & VOCATIONAL

Commercial and Vocational Education

SOCIO-economic institutions grow out of the irresistible urge of the historical forces. This applies with special significance to the growth of institutions for imparting education in commerce and vocations. Not until a decade or so ago did commercial and vocational education draw much attention in this part of the country.

The earlier institutions in the field of modern professional or technical education in Calcutta and near areas were perhaps the engineering classes attached to the Hindu College since 1844, the Calcutta Medical College in 1835 and the Law Department of the Calcutta Madrasah with the creation of Professorship in Law in the Hindu College in 1842.

The Calcutta University opened a degree class in commerce in 1926. The Vidyasagar College (previously Metropolitan Institution), established in 1879, took to commerce teaching in 1928, the Krishnath College (1857) in 1947, the City College (1884) in 1939, the Surendranath College (1885) opened a commerce department in 1941, the Bangabashi College (1896) took it up in 1942, the Asutosh College (1916) in 1945, and the St. Xaviers' College whose first affiliation dates back to 1862 started commerce teaching in 1946. It is not altogether accidental that World War I, the growth of nationalism in India, the great economic depression of the 'thirties, mass unemployment of the educated youth and other related circumstances led to a new interest in commercial and vocational education. At first, foreign business houses required only the typists, stenographers, and the routine assistants from among the Indians, and so the institutions grew up for imparting training in 'tool subjects' like typewriting, shorthand and book-keeping. With the growth of Indian business, largely as a result of World War I, and the tendencies in foreign houses also for recruiting business executives from among the Indians, the need arose for better commercial and vocational education organized along proper lines and capable of adjusting itself to the newer requirements of the times.

Present opportunities

University Education in Commerce: Quite a good number of colleges in West Bengal and almost all in Calcutta now provide facilities for education in commerce subjects like commercial geography, commercial mathematics and book-keeping along with civics, English and languages upto the Intermediate standard. There is, however, no separate Certificate Course in commerce as yet. As many as 11 institutions in Calcutta now teach Bachelor of Commerce (B. Com.) courses. Three separate institutions are being managed by City College, Commerce Department, where a vocational section is also attached for giving training in shorthand and typewriting. Over 14,000 students now-a-days read University Commerce Courses in Calcutta and about 80 per cent of them in "evening classes" held usually between 6 and 9 p.m. At present in three colleges, "day classes" in B.Com. are held and in two, classes are held in the morning. The overwhelming majority of the "evening classes" students are engaged during the day-time in business houses, either as proprietors, trainees or employees. The proportion of "irregulars", *i.e.*, those who had to give up studies before and took it up later, for improving their prospects, is fairly high.

Since the last session the University has also opened post-graduate classes in commerce in the evening and now there is a complete link of the university education in Commerce in the evening in Calcutta.

Vocational Institutions: There are in Calcutta roughly 150 institutions imparting training in shorthand, typewriting and book-keeping. Some of these institutions are usually affiliated to the Government Commercial Institute Board, which annually conducts final and special examinations in these subjects. There are quite a good number of un-affiliated institutions also and the standard of instructions varies widely from institution to institution. The total number of students in these institutions is not exactly known, but it would be nothing short of ten thousand approximately.

Vocational-cum-Technical Institution: With the growing demand for technical education, a number of vocational institutions have also undertaken to impart training in technical subjects like telegraphy, radio-engineering, etc. The George Telegraph Training Institute is probably the biggest of such institutions.

Technical Institutions: In Calcutta, the Board of Apprenticeship Training set up by the Government of West Bengal is perhaps the first noteworthy enterprise in Bengal and Calcutta for holding examinations for recruitment of apprentices in the workshops. Vocational education of the apprentices, theoretical and practical, is under the control of this Board.

The Industries Department of the State Government runs a few institutions near Calcutta for training students in the lines like paint manufacturing, leather, ink manufacturing, etc. Recently, the State Government has opened a few technical schools for training students, specially displaced youths, in different trades, like smithy, motor driving, weldering, electroplating, etc.

The Institute of Jute Technology recently organized in Calcutta is a grand new addition to the City's pride, and the Calcutta Technical School is probably the most important institution among the non-government technical institutions.

Government Commercial Institute: Contribution which is being made for about three decades by the Government Commercial Institute in equipping youngmen, who are either ineligible for the university course or who may not find opportunities for such a course, with training in shorthand, typewriting, book-keeping, secretarial practice deserves special mention. On the one hand the Institute rendered pioneering service by enabling thousands of our youngmen to earn living and, on the other, it maintained a steady supply of office-assistants of diverse type without which the business houses in the city and its suburbs could not carry on their normal activities.

The Institute is also affiliated to the All-India Board of Technical Studies in Commerce and Business Administration and imparts instruction to its students to qualify themselves for diploma and certificate examinations.

This year the Institute has obtained affiliation for preparing students for the B.Com. examination of the University of Calcutta and has thus added to the number of colleges recognized for the degree course in commerce.

All India Board of Technical Studies in Commerce and Business Administration: The Board is under the control of the Ministry of Education, Government of India and the only institutions which are affiliated to it in the city of Calcutta are the Government Commercial Institute and the City College, Commerce Department. Both the institutions impart instructions to students to qualify themselves for either diploma or certificate course of the Board. The diploma is recognized as equivalent to the university degree for purposes of certain appointments under the Auditor General of India and the Public Service Commission. The holders of diploma are also exempted from Registered (Chartered) Accountants' First Examination and are allowed to practice as Income Tax Practitioners under Sections 61 (2) iv (B) of the Income Tax Act, provided they pass in auditing as their special subject. The All India Certificate Course has been instituted with the object of affording opportunities to persons engaged in full time industrial, commercial or banking concerns for acquiring further knowledge in the subjects relating to their profession and thereby improving their prospects. The diploma course is a three years' full time day course followed by one academic year's (8 months) practical training in some recognized industrial or commercial concern arranged by the Board. The minimum qualification of a candidates is that he should be a matriculate or holding certificate of equivalent examinations. The certificate course is a post-unemployment, part-time and evening course of three years' duration. Candidates for admission must be above 16 years of age and must have read upto the matriculation standard.

London Chamber of Commerce: For many years the Chamber has been holding examinations for the award of certificates in the City of Calcutta and quite a considerable number of students have been taking advantage of it. Previously the examination was conducted by the Young Men's Christian Association on behalf of the Chamber and since the Association relinquished the responsibility, the conduct of the examination has been in the hands of the Institute of Commerce, located at 191/1, Bowbazar Street, Calcutta.

Institute of Cost and Works Accountants: Besides conducting examination in different stages to turn out cost and works accountants, the institute in Calcutta made, for some years, arrangements for imparting instruction in this specialized branch of study, which was subsequently discontinued. There is sufficient demand for such an arrangement in the city, but as it is never likely to be economically self-sufficient, the State should provide facilities in the larger interest of the nation's industry and commerce.

Diploma in Social Welfare: The arrangement for imparting instruction leading to the diploma in social welfare is being exclusively made by the University of Calcutta for the last few years. The expansion of industry which is proceeding on rapid strides and the growing consciousness of the millions of manual workers employed in them have created an increasing demand of trained personnel of labour welfare officers, whose services in industrial organizations are now being recognized to be indispensable. The course of studies for the diploma obtaining in the University of Calcutta serving a very useful purpose as it is should be re-oriented with due regard to conditions ushered in by the impact of ever-changing socio-economic factors. It will also be expedient to institute a degree course in the near future to attract and to extend scope to, persons of ability and talent. Arrangements should also be made by the State to provide facilities to the right type of trained labour welfare officers to go abroad to study the conditions obtaining in foreign countries with a view to re-organizing and systematizing the efforts which are being made in our country.

Education of the Defective

Calcutta Deaf and Dumb School

CALCUTTA Deaf and Dumb School which is the premier and the largest school for the deaf in India was established in May, 1893 with only two pupils, sons of Girindra Nath Bhose, a scion of the rich Bhose family in the city of Calcutta. The founder-teachers were Srinath Sinha, Mohinimohan Majumdar and Jamininath Banerji who taught without any financial consideration at the start of the school. From the beginning, it was a public institution with a Managing Committee of which Sir Cecil Stevens, I.C.S. was the first President and Principal Umesh Chandra Dutt of the City College the Founder-Secretary. Jamininath Banerji, the Head Master and the first Principal of the school, received training at the National College of Teachers of the Deaf, London and the Gallaudet College, Washington D.C., U.S.A. and was primarily responsible for the reorganization of the school along modern lines.

In 1896 a Normal Department to train teachers was started. Teachers trained from this department have gone out to the farthest corners of India. The school has now an enrolment of 230 students, boys and girls, over 50 per cent of whom live in the school boarding. The oral method of instruction is followed, by which the deaf-mute pupils are taught to speak and to lip-read as also to read and write. Content subjects like literature, arithmetic, geography, history, hygiene and elementary science are taught. Recently a class has been equipped with electric hearing aids to help such students who possess usuable residual hearing. The school maintains a Poly-technic Department with a fairly wide variety of shops for vocational guidance and training, both for boys and girls. Hitherto over 1300 students have gone out from this school, and most of them are earning their livelihood on decent wages.

The school has the following plans for future development:

(1) There is a plan, estimated at Rs. 10,00,000, to run an industrial institute on an all-India basis. The institute will be administratively attached to the school and will be situated near Calcutta. It will be a cottage industry institute on a co-operative basis. The plan is now before the Government of India for their consideration.

(2) The Teacher Training Department may be further developed with organizations and equipments for research in phonetics, electrical acoustics and experimental psychology. A plan for this has been submitted to the Government of India.

(3) The teaching in the Academic Section is proposed to be extended upto the Secondary Education level, with vernacular as the medium of instruction.

(4) Wider provisions will be made to help more fully the partially hearing children with electrical aids for which an appeal has been submitted to the United Nations Organization through the Government of India for gift of equipments.

Calcutta Blind School

At Behala, in the suburbs of Calcutta, six miles from the heart of the city and surrounded by a beautiful campus and overlooking a large swimming pool, is situated the Calcutta Blind School, a pioneer institution for the education of the blind. The history of the School goes back to the early spring of 1894. In that year the late Rev. Lal Bihari Shah, the Founder of the School, became acquainted with Mr. L. Garthwaite who initiated him in the Braille system of reading and writing for the blind. For nearly three years Rev. Shah worked at the Braille method and finally succeeded in adapting it to the Bengali language. This was a striking achievement, seeing that Bengali, besides having a larger number of letters in the alphabet than French which is the origin of Braille, also possesses a number of combined letters and half-vowels. In order further to qualify himself, Rev. Shah got in touch with the British and Foreign Blind Association, (since called the National Institution for the Blind) London. Thus equipped in 1897, he opened a home and school for the blind at his own house at 154, Karaya Road (now Park Circus) with only one pupil on the roll. In March 1898, three more boys came to him. In March 1899, the first annual meeting of the School was held in Calcutta under the chairmanship of the late Mr. Kali Churn Banerji, a distinguished leader of Bengal. This meeting brought the institution to the notice of the public. The School moved from place to place, and for 13 years Rev. Shah carried it on single-handed. He himself became blind in 1910. He was able at this stage to enlist the active support of the late (after Sir) Archdale Earle and the late Mr. W. R. Gourley, and in 1911, the School was registered as a Society under the Societies Registration Act (XXI of 1860) with a Court of Governors of which Sir Archdale Earle was the first President, Sir Rajendra Nath Mookerjee and the Maharajadhiraja Sir Bijay Chand Mahtab Bahadur of Burdwan, the first Vice-Presidents, and Mr. Gourley, the first Secretary.

Successive Governors of Bengal have taken keen interest in the work of the School and helped it in many ways. The present permanent habitation was secured through the efforts of Lord Ronaldshay (later the Marquess of Zetland), the then Governor of Bengal. The first and the main portion of the building was opened on March 31, 1925 and the dormitories on the first floor on December 18, 1937. The total area of land possessed by the School is about 9 acres.

Out of 1,60,000 blind people in India, the population of blind adult and children in Bengal alone is about 40,000. Many more schools for the education of the blind, organized along the lines of the Calcutta Blind School, are needed to make this huge number of the physically defective population useful to the community.

SECTION III

MUSEUMS, GARDENS & LIBRARIES

Museums

Indian Museum

THE Indian Museum, popularly known as *Jadughar* (the house of magic), occupies a majestic and massive building at 27, Chowringhee, where it is readily accessible by trams and buses from all parts of the city. The open ***maidan*** in front of it and the Museum Tank and associated gardens and lawns in its compound lend a very picturesque appearance to the building. The Government College of Arts and Crafts and the United Service Club share with it the Chowringhee front between the Sudder Street on the north and the Kyd Street on the south. The institution celebrated its centenary in 1914, even though the present building became ready for occupation in 1875 only, for the Indian Museum was established by the Asiatic Society in 1814, in its own premises at 1, Park Street, which is still known as ***Purana Jadughar***. The Society was founded in 1784 and soon after curiosities began to accumulate. Although the idea of preserving these collections in a suitable building was mooted in 1796, it was not until February 2, 1814, that this proposal found ready acceptance with the members of the Society, when Dr. Nathaniel Wallich, the renowned Danish Botanist of Serampore, offered to act as the Honorary Curator. With the institution of this organization in its present pattern, its scope was also well defined as an institution for the reception of all articles that might be sent to illustrate oriental manners and history, or to elucidate the peculiarities of Art and Nature in the East. Under the able stewardship of Dr. Wallich, the Museum flourished in the succeeding years. In May 1862, the Government of India realized that the foundation of a public museum in Calcutta was one of its duties and seriously considered the finalization of the negotiations initiated earlier by the Asiatic Society for the foundation of an Imperial Museum in Calcutta. It was about the middle of 1865 that the Society agreed to hand over its zoological, geological, and archaeological collections to a Board of Trustees for the proposed Museum. The Indian Museum Act XVII of 1866 was consequently enacted to provide for the establishment of a Public Museum at Calcutta, and out of 13 Trustees, 4 were drawn from the Asiatic Society. The Act was revised in 1876, 1887 and 1910. According to the present constitution, the Board of Trustees consists of 18 persons, only one of whom is a representative of the Society. Thus the Society's interests in the Museum were gradually overshadowed and replaced by those of the Central (Union) Government.

The Museum is full of historic collections, only a small part of which is usually put up in public galleries as exhibits. The Reserve Collections are extensive and are only accessible to *bona fide* students of arts and sciences. Though in the beginning the entire Museum was under the charge of a Curator or Superintendent, its public galleries are now divided into six sections, namely, Archaeological, Geological, Industrial, Zoological, Anthropological and Art Sections. Only the Arts Section is directly under the charge of the Trustees, while the other Sections are managed by Government Departments placed under different Ministries of the Government of India. There is thus no unified policy with regard to the working of the Indian Museum as a single institution of public education, recreation and research. The following is a brief description of the different Sections:

Archaeological Section: The Archaeological Section, consisting of four galleries, is undoubtedly the richest in the East and is under the Ministry of Education. The organization of the galleries after the military occupation during the world war II is not yet complete. Recently also some of the early sculptures had been removed to the National Museum, New Delhi. The antiquities from Harappa and Mohenjo-daro said to be 5,000 years old are the most remarkable in the collection pointing to the hoary antiquity of Indian civilization. The other exhibits dating from 4th century B. C. consist of precious relics, capitals of monolithic columns of Asoka, monumental human figures, great carved railings of Bharhut, and a splendid array of stone and bronze sculptures representing all phases of Indian plastic art, *viz.*, Gandhara, Kushana, Gupta, Mediæval etc. A few notable pieces from Indonesia and Indo-China are also displayed. The Muslim Gallery contains a large collection of Arabic and Persian inscriptions and carved stones illustrating Indo-Muslim decorative art. The coin-collection too are unique in its variety.

Geological Section: The Section is under the Ministry of Natural Resources and Scientific Research. Thoroughly organized after the war and oldest of its kind in the East, the Geological Section is comprised of four galleries of which the Siwalik, Meteoric and Mineral galleries occupy the northern wing of the ground floor and the Fossil gallery is situated in the same wing of the first floor. The Siwalik gallery derives its name from the fossilized skeletons of the higher vertebrates displayed in it, flourishing millions of years back in the Indian sub-continent. The large collection of meteorites displayed in the Meteorite Gallery is the largest in Asia and fifth in the world. A new attraction of the same hall is the "Minerals in Industry" section, along with a comprehensive collection of rocks, showing economic products of the States. In the verandah adjacent, a huge fossilized tree trunk of *Dadoxylon* measuring about 72 feet obtained from the lower Gondwana rocks near Asansol is on view. Plant fossils, and vertebrate and invertebrate remains form part of the Invertebrate Gallery.

Industrial Section: The Industrial Section, under the Ministry of Food and Agriculture, consists of raw materials and finished products of the Indian vegetable world. Industries from mineral products exhibited in different galleries also form part of the Section. About 100 varieties of paddy as cultivated in Assam and Bengal, edible fruits, medicinal plants, food grains, cereals etc. from different parts of India are displayed. The process of manufacture of quinine, opium, tea, paper and match box are prominently exhibited in different show cases. All kinds of fibres showing the stages from the raw materials to the finished product are on view. During recent years the gallery has been greatly enriched by collections. There is also a herbarium of plants of economic and medicinal importance.

Zoological Section: The Zoological Section, also under the Ministry of Food and Agriculture, is divided into two groups: (1) the collections exhibited in the public galleries and (2) the Reserve Study collections. The six public galleries consist of a very extensive and up-to-date Invertebrate gallery and Insect gallery on the ground floor ; and a Small fish gallery, Amphibian, Reptilian and Bird gallery, the large Mammal gallery, and the Small Mammal gallery on the first floor. In these galleries representatives of almost all types of animals of the groups found in India are exhibited. In special cases foreign animals not found in India are also shown to complete a general survey of the animal kingdom. The Reserve Study Collections are of a far greater magnitude than those exhibited in the public galleries, forming the basic material on which original work on Indian Zoology has been carried out. Perhaps the worst victim of the military occupation, the Zoological Section has recently been completely reorganized.

Anthropological Section: So long a part of the Zoological section, the Anthropological Section, situated on the first floor of the wing, facing Sudder Street has recently been separately organized and is under the Ministry of Education. Mainly consisting of ethnological specimens of different Indian tribes like those of Assam, Nagas, Ao-Nagos, Daflas, Niri, Mismi, Mikir etc., it also includes the Andamanese and Nicobarese Section. Other important exhibits comprise of different kinds of musical instruments evolved and primitive, various fishing appliances, agricultural implements and types of tribal and modern weapons both defensive and offensive.

Art Section: Established in 1876, the Art Section has taken its present shape in 1911. Situated on the second floor of the Chowringhee Wing, the gallery has been properly restored to its pre-war condition only recently. The New Art Section, "a pageant of royal Oriental splendour", is divided into three sections, *viz.*, (1) Paintings consisting of Rajput and Mughal water colours of 17th-18th century together with a few on ivory and mica, Tibetan banners and modern paintings ; (2) Hard-wares consisting of metal, stone, glass, earthen, lac and lacquered and papier-mache wares, ivory and horn figures, leather articles, painted and inlaid wooden wares, wood carvings and mosaic ; and (3) Textiles consisting of the finest brocade Saris, Himrus, Muslims, Shawls, Phulkaries, Soznies, quilted Fards, embroidered nets, etc. The Section is directly under the Trustees of the Museum.

According to the Act, the Trustees have power "to acquire and hold property, to enter into contracts, and to do all acts necessary for and consistent with the purpose of this act", but unfortunately the Trustees have no funds of their own, as the public benefactions have been nil and every pice for the expenditure on providing amenities to the public has to be obtained from the Government in the Ministry of Education. As regards exhibits, their display is antiquated, for lack of funds and space make it impossible to render them more educative to the public.

The Museum was occupied by the Military during the war (28th June, 1942 to 10th August, 1946) and much damage resulted to the Museum exhibits thereby. From a Compensation Fund (Rs. 3,68,643-5-0) a great deal of restoration and reconstruction work has been done but much still remains to be done.

Asutosh Museum of Indian Art

Named after Sir Asutosh Mookerjee, this regional museum was started by the University of Calcutta in 1937 with a view to collecting and preserving representations of different phases of Indian Art, specially the art of Bengal and Eastern India. It was also intended to serve as a laboratory of practical work for the students of Ancient Indian History and Culture Department of the University. Since then the number of exhibits have exceded 8,000 items. It is housed in the rear portion of the Senate Hall, consisting of one big hall, a sculpture gallery on the ground floor, a painting gallery, a corridor containing textiles and other minor antiquities and a laboratory for cleaning and preservation of collected antiquities.

The first University Museum in India, it started initially with only 50 exhibits and has now a representative collection of stone, and bronze sculptures, terracotta figurines, paintings, textiles, ivory and wooden objects, manuscripts, objects of folk art and coins of various kinds. Emphasis has been laid on objects collected from Bengal, Bihar and Orissa which for many centuries had formed a homogeneous cultural unit. These exhibits exhaustively illustrate the different phases of art, specially in Eastern India, from as early as the second century B.C. right upto the modern age and include some rare and unique specimens of sculpture and painting illuminating the manifold facets of the cultural history of India.

Most of the exhibits in the museum have been acquired as gift from donors as well as teachers and students who have collected them from different areas. Exhibits worth barely Rs. 12,000 have been purchased during the last twelve years. The present valuation of the Museum Collection probably exceeds rupees ten lakhs.

The museum has attached to it an Excavation Section under a University Lecturer. Excavation works have so far been conducted at (1) Bangarh in West Dinajpur and (2) Nanoor in Birbhum, both in West Bengal and the report of these archaeological diggings published.

The Museum occasionally holds lectures on various aspects of art and antiquity, provides regular facilities to affiliated college and school students to be shown round the galleries, and holds exhibitions. The Museum runs a short term Art Appreciation (Teachers' Training) Course during the vacation months of April-July in order to train art teachers of secondary and intermediate colleges in theoretical and practical subjects. Publication of the museum includes guide books, brochures, monographs, and post-cards.

There is a Seminar attached to the museum which has a collection of books on art, archæology, museology, and number of journals, Indian and foreign. There is a coin cabinet consisting of more than 1,500 coins covering ancient, mediaeval and modern periods of Indian history including some rare specimens.

The Museum started a Rural Culture Survey Scheme in 1941, to study cultural patterns of rural areas, *e.g.*, rural arts and crafts, aspects or rural culture, and archaeological monuments surviving in Eastern India, specially in West Bengal. The Curator has made a special study of the traditional arts and crafts of rural Orissa.

Victoria Memorial

Victoria Memorial takes its place as one of the great buildings of the modern world. Standing in its own grounds, west of the Cathedral, on the site of the old Presidency Jail, it dominates southern Calcutta. Lord Curzon conceived the idea of the Memorial as a treasure house wherein to display a collection of pictures, statues, historical documents and other objects of interest illustrative of Indian history and especially of that of the Victorian era and act was passed in the then Imperial Legislature known as Victoria Memorial Act X of 1903. The funds for its construction, amounting to seventy-six lakhs of rupees, were subscribed by the Princes and the people of India. The foundation stone of the Memorial was laid on January 4, 1906, and the building was formally opened on December 28, 1921. The design is chiefly Renaissance in character, though traces of Saracenic influence can be described. The exterior is of polished marble quarried at Makrana in Jodhpur. The ornamental groups of statuary over the entrance porches and figures surrounding the dome were designed and executed in Italy.

The figure of Victory, standing 16 ft. high and weighing 3 tons, surmounts the dome and revolves upon its own base, a sphere 2 ft. in diameter. From the ground level to the base of the figure of Victory is 182 ft. The dimensions of the hall itself at the corner towers are 339 ft. by 228 ft.

Entering by the northern door, to the right, in the Royal Gallery, one finds a collection of paintings representing events in the life of Queen Victoria, the gift of King Edward VII and also of Queen Victoria's piano and writing desk occupying the centre of the room.

On the opposite side of the entrance hall a collection of Persian books will be of interest to the antiquarian. Pictures on the walls include those of the King of Oude and the Nawab of Arcot and of Dwarkanath Tagore (1795-1846).

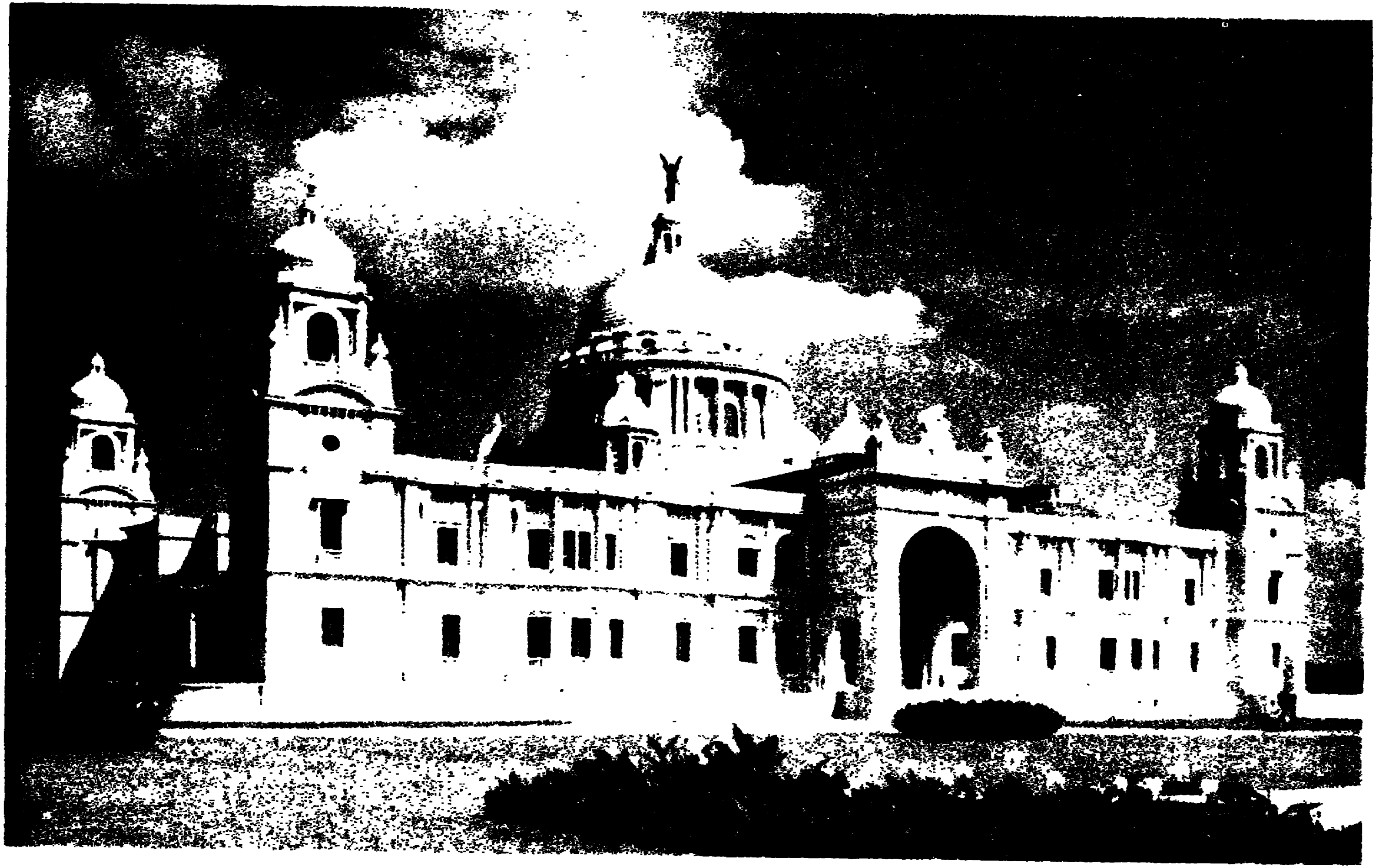
Passing through the Queen's vestibule into the Queen's Hall under the dome, one sees the dignified statue of Queen Victoria at the age when she ascended the throne; this gives the key-note to the whole edifice. The mural paintings encircling the gallery illustrate the principal events of her life time.

The bronze doors on two sides of the Queen's Hall are fine examples of modern workmanship and beyond them, on the terraces are groups of statuary. Two French guns captured at the Battle of Plassey are the principal objects in the Prince's Hall. Another replica of the pre-British rule is preserved in the Darbar Hall, undoubtedly the finest hall in the building, containing a fine collection of Oriental paintings. On the dais at the east end of the Hall, stands the stone throne or the "Musnad" of the Nawabs-Nazim of Bengal, an exhibit of considerable historical interest, dating from 1641, according to the inscription.

The Picture Gallery on the first floor include portraits of Warren Hastings and Mrs. Hastings by Zoffuny, engravings and medals, and also instruments used in the Great Trigonometrical Survey of India. The "Calcutta" room contains Daniell's prints of Old Calcutta and a model of Fort William. The original indictment of Nand Coomar for forgery is also displayed in the annexe. Those who wish may ascend to the top of the dome, from which magnificent views of Calcutta may be obtained and into the "Whispering Gallery."

Bangiya Sahitya Parishad

The Bangiya Sahitya Parishad has a nucleus of a museum, chiefly provincial in character, of historical and archæological interest. Its collection comprises of images of the Gandhara, Kushan, Magadha and Bengal Schools. Besides a large number of these images of metal as well as stone, there is a rich collection of rare old coins in its cabinet. Some of these specimens are quite unique, and among these may be mentioned three bronze images which were described by the renowned art critic Mr. William Rothenstein, a former President of the Indian Society of London, as "impossible to match." There is a collection of the personal relics of the distinguished literary luminaries of the province. The *pugree* or head-dress, and the plaster cast of the head of Raja Rammohan Roy are interesting. The Parishad may also veritably be called a national portrait gallery owing to its possession of a very large number of portraits of the distinguished sons of Bengal.



THE GREAT BANYAN

HERBARIUM BUILDING SHOWING SIR GEORGE KING'S REPLICA & FEW CABINETS CONTAINING VALUABLE COLLECTIONS

Indian Botanic Garden

ROYAL Botanic Garden, Calcutta, renamed as the Indian Botanic Garden since January 26, 1950, was founded in January of 1787 by the then East India Company at the suggestion of Robert Kyd, R.E. Secretary to the Military Board at Fort William, Calcutta. It is situated on the right bank of the Hooghly and was instituted for the economic benefit of the country. To quote the words of Sir Joseph Banks, the King's botanist in London at that time, the garden was established with the two-fold purpose of "conferring on the inhabitants of that circle of the globe, the greatest of earthly benefits and increase of their resources in food, in raw material and in luxuries by receiving from the West such useful plants as the East did not then possess and by sending to the West such, as hitherto exclusively belonged to the East and secondly for extending the interesting science of Natural History and more particularly that of Botany".

Robert Kyd's private collections of exotic plants, brought to him from the distant Indies, China, and other countries, formed the nucleus around which the garden steadily grew to its unique and unparalleled position of the second largest botanical garden in the world in extent, in the stock of Indian and exotic plants, in its achievements firstly as the *Bureau of Plant Introduction* and secondiy as the centre for the study of the systematic botany of India and the neighbouring countries. It now occupies an area of 273 acres and has a collection of about 16,000 tropical arboreous plants, hailing from distant parts of the world grown in the open and rightly possess a herbarium of several millions of dry plants and plant materials authentically named and preserved scrupulously so as to last for an indefinite length of time.

Robert Kyd, the founder Superintendent of this Garden, was succeeded by a galaxy of eminent Superintendents who not only exhibited knowledge of agri-horticulture and scientific botanical excellence of international standard but also left behind them indelible marks of scientific publications for the benefit of the posterity. Dr. William Roxburgh, the Company's botanist at Madras, succeeded Kyd in 1793. His *Hortus Bengalensis,* a catalogue of plants, in cultivation in the garden during his tenure of superintendentship and his *Flora Indica* which was, however, published posthumously in 3 volumes by the far-sighted missionary botanist Dr. William Carey of Serampore in 1832, earned him world fame. Dr. Roxburgh has also left us a collection of 2,382 portfolio size coloured drawings of Indian plants prepared by Indian botanists. Known as Roxburgh's Icones, these drawings have not been published till now, though most of them are of exceptional value as types of a large number of Indian species of plants. After Dr. Roxburgh, the post of Superintendent of the garden was held in succession by such distinguished botanists as Dr. Francis Hamilton (once Buchanan), Dr. Nathaniel Wallich, Dr. William Griffith, Dr. H. Falconer, Dr. Thomas Thompson, Dr. Thomas Anderson, Sir George King, Sir D. Prain, Lt.-Col. A. T. Gage, and

Mr. C. C. Calder ; the present incumbent being Dr. K. Biswas. Dr. Francis Buchanan (afterwards Hamilton) was famous for his collection of botanical materials from Nepal and greater Bengal and his topographical survey of Behar and Bengal and Mysore. Dr. Wallich organized extensive botanical surveys in the distant and little known regions of Kumaon, Nepal, Sylhet, Tenasserim, Penang and Singapore. His name has now become a bye-word in the systematic botany of India by his catalogue known as "*Wall. Cat.*", a collection of the plant materials of India brought together up to the year 1828—a classified and named list of Indian plants, totalling 9,000 numbers with numerous duplicates, which was made into a number of sets and distributed liberally from London to all the leading botanical institutions of Europe. The herbarium of this botanical garden had, however, not yet the good fortune to possess the original complete set, kept at the Kew herbarium, of these unique and more or less type collections of Indian species. Dr. Wallich was the first Conservator of Forests in charge of the teak plantation which occupied the eastern corner of the garden. Dr. William Griffith, a young botanist of great promise, was lost to science by his early death. He was connected with the first discovery of the Assam tea plant. His botanical researches covering a large field were published posthumously by his friend Dr. McClelland. Dr. Anderson was responsible for the introduction of the cinchona in the Darjeeling hills, and his monograph of the Indian Acanthaceæ is a monumental contribution to science. Dr. Thomson (1855-61) was the co-adjutor of Sir Joseph Hooker and the joint author of a new *Flora Indica.* He fell victim to malaria in 1870, contracted during his efforts in connection with cinchona. Dr. G. King (afterwards Sir) whose tenure of office extended from 1871—1898, happened to come immediately after the two severe devastations to the garden caused by the great cyclones of 1864 and 1867. He had practically to remodel it as a scientific institution and as a place of public interest. By his tireless energy and by his genius for landscape gardening, he altered the general aspect of the garden within a few years, both as a phytogeographical scientific centre for the study of Indian plants and also as a charming pleasure ground. The herbarium collections which had gradually accumulated after its depletion by Wallich and grew in importance, were transferred to the new buildings which were built on the model of the Kew herbarium in London. In this work of transferring and rearranging, classifying and naming the sheets, King had the assistance of Brace and after him of Dr. Pain as Curator of the herbarium.

Dr. D. Prain (afterwards Sir) succeeded Sir George King in 1898 and continued as the Superintendent till his appointment in 1904 as the Director of the Royal Botanic Garden, Kew, in London. The garden was sketched out by him on a proper geographical basis, which was continued with slight modification up to the present day by his successors. He was not only an astute gardener but a botanist of high calibre. His botanical publications in the *Annals* and elsewhere are too many to be listed here. His successor Lt.-Col. A. T. Gage issued a garden catalogue published as Vol. V of the *Records of the Botanical Survey of India.* He was also instrumental in the extension and development of cinchona in India and Burma on a commercial scale. The tradition of only medical men holding the post of the Superintendent was at last broken by the appointment of Mr. C. C. Calder in 1923 who succeeded Lt.-Col. A. T. Gage.

The garden which is open to the public from sun-rise to sun-set possesses a network of well-laid macadamized roads, enabling the visitors to comfortably drive along through the entire garden of such vast extent. It can be approached from the Howrah side by the Howrah gate, situated on the north-east corner, up to which point buses run from Howrah. The steamer service between Calcutta and the garden across the river has now been suspended. The garden can, however, be approached by crossing the river by country boat from Matiabruz which lies opposite the Garden on the left bank of the Hooghly. The Mahogany Avenue, the Amherstia Avenue, Albizzia Avenue, the Polyalthia Avenue, the Scott Avenue, with the peculiar buttressed roots of *Pterygota alata*, characteristic of some tropical trees, the magnificent Palmyra Avenue more than half a mile long with decorative creepers at the base of the Palmyra trees planted during Roxburgh's time, the Arboreta, Rockeries, the Mangrove peats, Pandanetum, Bambusetum, Palmetum, the Fern Houses, Cactus and succulent Houses, the student garden, the nurseries, the colourful vistas, are some of the interesting places of beauty and study, which make an unforgettable impression on the minds of its numerous visitors. Among the noteworthy objects for the visitors to see is the well-known 'Great Banyan tree'—the pride of the garden about 200 years old. It is situated on the western boundary of the garden. Its spreading interwoven branches form leafy canopy overhead and the graceful pillar like more than 800 aerial roots cover an area of 133,200 sq. ft. approximately. The main trunk had to be removed in 1925, after an attack of woody fungus and insects.

The imposing Kyd monument in the centre at the junction of the Hooker and Kyd Avenue stands facing the Oreodoxa Avenue and flanked with double row of Mahogany on either sides of the water gate to the south and the Orchid House to its north. The large and the small palm houses situated to the north and north west of the red building in the middle of the garden are other charming spots worth visiting.

Lloyd Botanic Garden, Darjeeling

In 1878, a botanic garden was laid out at Darjeeling by the efforts of Sir Ashley Eden, the then Lieutenant Governor of Bengal. It was named after Mr. William Lloyd who made over to Government 40 acres of land within the town of Darjeeling. The garden developed under the guidance of Sir George King, and since its establishment it has always been under the Superintendent, Indian Botanic Garden, Calcutta. In this garden are represented in miniature the temperate flora of the world with special reference to submontane, montane, subalpine and alpine flora of the Himalayas.

The Lloyd Botanic Garden has been recently rearranged phytogeographically, and its roads named. A catalogue with a plan of the garden was published under the title of *"Plants of the Lloyd Botanic Garden, Darjeeling"* in the *Records of the Botanical Survey of India,* Vol. V, No. 5, 1940.

Herbarium at Sibpur

Herbarium of the Indian Botanic Garden which now contains about five million dried specimens, including types, co-types of Indian plants and plants of the neighbouring countries, is one of the largest botanical centres, to which problems of systematic botany and its allied branches are referred to and solved. It is the 'mecca,' as the late Sir Arthur Hill said, of the systematic botany of India for botanists not only in India but from countries across the seas. The library attached to this herbarium contains about 30,000 volumes of books and journals, some of which are the oldest and irreplaceable dealing mostly with systematic botany of India and the world. Dr. King initiated the publication of the *Annals of the Royal Botanic Garden* which contains illustrated monographs on Indian and other plants, the first volume of which appeared in 1888. Fourteen volumes in royal folio size have already appeared in this series.

Zoological Gardens, Alipore

CALCUTTA'S Zoological Garden covers an area of nearly 48 acres and is situated in the Alipore section of the town south of the Race Course across the Zeerut Bridge over the Tolly's Nallah. It is next to the Belvedere, formerly the Calcutta residence of the British Viceroys now housing the National Library. Unfortunately, it is not easily accessible by public transport but recently the route of Bus No. 3 has been so adjusted that it passes between the Zoo and the Belvedere. It is also accessible from the Kidderpore side but nearly a quarter of a mile's distance lies between it and any public transport.

The Government of Bengal, in co-operation with the public, established the Zoo in 1875 and it was inaugurated on the 1st January 1875 by the late King Emperor Edward VII, then Prince of Wales. Efforts have been made to keep the animals in their natural surroundings; so the place looks like a small natural zoological park with clusters of trees and water areas.

There are many big and small animal houses, enclosures and aviaries at present, housing a varied collection of popular wild animals, birds and reptiles of the world.

The Alipore Zoological Garden is a magnificient institution of its kind having the following features of special interest:

(1) *The outdoor aviaries.*—These are constructed adequately, suiting the climatic and other condition of lower Bengal. Quite a number of species of popular birds are kept in a free state within the compound.

(2) *The ornamental lake.*—This is a water area stretching in the centre of the garden containing islands with flowering and other trees and harbouring a large number of aquatic feathered creatures.

(3) *Bird Sanctuary.*—The quiet and congenial atmosphere prevailing in the spacious grounds and waters of the Zoo, induces many aquatic and arboreal birds, like night-herons, snake-birds, cormorants, teals and others, to find a sanctuary and home in the garden. Lesser whistling teals, the winter visitors, swarm in thousands in the large lake from November to April, conveying in turn the message of the approach of winter by their arrival and of the breeding season by their departure.

(4) *The Garden* contains many rare and original plants, including an excellent collection of varieties of flowering and non-flowering trees. Its landscape gardening deserves mention.

Amongst the animal collection in the Garden mention may be made of:

(1) *The giant tortoises.*—They are the oldest denizens of the Garden (from 1875) and are likely to continue to thrive in their enclosure and home through a greater part of the next century.

(2) *Japanese giant salamanders.*—Presented by the Tokyo Zoo.

(3) *A pair of Japanese brown-bear.*—Also from the Tokyo Zoo.

(4) *Many large and small carnivorous animals.*

(5) *Indian rhino couple.*—6 hippopotami, 2 born in the Garden, elephants, giraffes and bisons.

(6) *Good many species of hoofed and horned animals.*

(7) *Many types of monkeys,* including gibbons (black), orang-outangs and several other rare varieties.

(8) *Reptile collection,* housed in the Reptile-House.

(9) *The rich and colourful exhibit of birds.*—Collection of birds in the Alipore Zoo is unique. They are housed and looked after well.

During the last World War, the Zoo was under military occupation and many of the important exhibits, specially greater and lesser carnivora (cats), were destroyed or removed elsewhere. It has not yet been possible to bring it up to its pre-war excellence.

The Garden is administered by a Board of Honorary Committee. Annual income is in the neighbourhood of Rs. 3,00,000/-, and the expenditure more or less the same. Major portion of the income is derived from entrance receipts from visitors to the Zoo. The average number of visitors in a year is 18 lakhs

Libraries

THE growth of libraries in a city is a sure index to the intellectual craving of its citizens. The number and variety of the libraries in Calcutta together with the quality of service offered speak highly of the cultural activities of this great city. With a population of about 26 lakhs and an area of 33 square miles, Calcutta has a network of more than 400 libraries excluding the school collections. This figure would mount to 550 if those libraries which are technically outside the limits of the Corporation, but lie in Greater Calcutta, are taken into account.

As regards variety there are the libraries of government departments, of learned societies and professional bodies and public libraries; there are the libraries of the University and research departments, of clubs, hospitals and technical institutions; there are also the subscription libraries run by individuals or bookshops. Some of them observe the most up-to-date principles of library science while others are ignorant of these rules. Such a variety of libraries provide immense resources for the students of arts and science. Some of these libraries possess unique collections in their own fields and readers from all parts of India and abroad must necessarily come to Calcutta to complete their studies on the subjects.

Growth of Calcutta Libraries

These valuable stores of knowledge in the Calcutta libraries have been gradually accumulated in the course of the last 175 years. Since the beginning of the last quarter of the eighteenth century, Calcutta has become a centre of great cultural activities. These early activities were mainly due to the desire among the Indians and Europeans to know each other. The oldest milestone of cultural progress is the Asiatic Society of Bengal, founded in 1784 by Sir William Jones. Already several schools had been opened in the city by foreigners to impart Western education to the Indian public of which the most important were the Hindu College (1817) and the Oriental Seminary (1823). The College of Fort William (1800) appointed Indian scholars to train civilians from England in the language and literature of the country. With the spread of education the citizens of Calcutta felt an urge for further study in the fields of Eastern and Western knowledge. Printed books from Europe and manuscripts from this country were being collected by these institutions and thus unconsciously laid the foundation of the future libraries in the city. The invention of Bengali types and the printing of books by the Missionaries of Serampore also gave a great impetus to the reading and collection of books.

The month of August, 1835, forms a landmark in the history of public libraries in Calcutta. The citizens of Calcutta assembled at a meeting in the Town Hall on August 20 and resolved to establish a public library to be housed in a building which would bear the name "Metcalfe Library Building". The main object of the conveners of this meeting, however, was the building of the Metcalfe Hall and the idea of the library came in as a second thought to put the

Hall to some use. Ten days later another meeting of the citizens, quite independent of the former, was held to consider the possibilities of establishing a public library in the city and the following unanimous resolution was adopted: "That it is expedient and necessary to establish in Calcutta a Public Library of reference and circulation that shall be open to all ranks and classes without distinction and sufficiently extensive to supply the wants of the entire community in every department of literature."

As an outcome of this meeting the Calcutta Public Library was opened to the public on the 8th of March, 1836. The "Metcalfe Library Building Committee" ultimately dropped the idea of establishing a new library and instead offered accommodation to the Calcutta Public Library in the Metcalfe Hall which was built mainly through their efforts. Thus the two separate moves virtually became united and the result was a library which was the first of its kind in the East. The European curators of the Library remarked: "While the question of establishing public lending libraries is agitated in England it must be a source of pride to the inhabitants of this metropolis to know that they already possess one which in point of liberality and subservience to public benefit may challenge comparison with any European institution."

Other memorable events in the history of the growth of Calcutta libraries are the foundation of the Indian Museum and University libraries between 1870-'75, and the opening of the Imperial Library to the public by Lord Curzon in 1903. The Bangiya Sahitya Parisad was established in 1894 and it was the first to make a systematic collection of Bengali books.

The Bengal Library Association and the Indian Library Association were founded in 1925 and 1933 respectively with their headquarters in Calcutta (the office of the I.L.A. has since been removed to Delhi) and they substantially contributed towards the improvement of the libraries of the city. The majority of the local library workers, who are responsible for efficient service, had their training in the Imperial Library where training classes were first opened in 1935. Now they are being held by the Bengal Library Association and the University. It will become apparent to any observer that the influence of these Associations and training classes has spread beyond the boundaries of Calcutta and West Bengal.

The libraries in Calcutta may be roughly classified according to their prominent characteristics. Only more important libraries in each group can be noticed. In cases where up-to-date information is not available figures have been taken from Bengal Library Directory, 1942.

General Research Libraries

The National Library: The present National Library owes its foundation to Lord Curzon who formed it by the amalgamation, in 1902, of the Calcutta Public Library with the then Imperial Library which itself had been formed in 1891 by an integration of a number of departmental libraries of the Government of India. Of these the collections of the Home Department, the Fort William

College and the East India Board, London, were most important. The Calcutta Public Library occupied a unique position as the first public library; but its glory began to fade as libraries grew up in different parts of the city. Various other factors also worked for its decline. The Library had almost ceased functioning when Lord Curzon visited the Metcalfe Hall in 1899 with the object of offering to the citizens of the capital of India the services of a first class library. He was impressed by the valuable collection of the Library and was successful in effecting its amalgamation with the Imperial Library after purchasing the rights of its proprietors. Opening the Imperial Library on the 30th of January, 1903, Lord Curzon said: "It is intended that it should be a library of reference, a working place for students and repository of materials for the future historians of India, in which, as far as possible, every work written about India at any time can be seen and read."

With a stock of about six lakhs of printed books and periodicals, it is the biggest library in India. But the number of manuscripts is comparatively small, the present figure being 1,540. The Library is rich in the following classes of publications: (*a*) books on India; (*b*) India and State Government publications; (*c*) the United States documents; (*d*) Parliamentary papers; (*e*) the League of Nations and United Nations publications; (*f*) old newspapers and periodicals.

This Library has built up a very good stock of American publications through the fine gifts from the U.S. Government, Library of Congress and the Smithsonian Institution. It enjoys some limited copyright privileges as far as West Bengal publications are concerned and as such the Library has a representative collection of books published in Bengal during the last fifty years.

The Library has four special collections known as the Buhar, Sir Ashutosh Mukhopadhyay, Ramdas Sen and Hyderabad Residency Collections.

(1) The Buhar Library—A collection of 950 Arabic and Persian manuscripts and about one thousand five hundred printed books in Arabic, Persian and Urdu were presented to the Library in 1904 by Maulvi Sayyid Sadr-ud-Din Ahmad-ul-Musavi, zemindar of Buhar, in the district of Burdwan. This collection is known as the Buhar Library. All Arabic, Persian and Urdu books subsequently added to the Library have become a part of this collection.

(2) Sir Ashutosh Mukhopadhyay Collection—The splendid collection of the late Sir Ashutosh Mukhopadhyay was presented to the Library by his sons in 1949. It contains about 80,000 books covering subjects so diverse as literature, history, philosophy, economics, mathematics, physics, anthropology, law, art, etc. In fact, it is a rich library of well-chosen publications reflecting the wide and scholarly interests of the great collector.

(3) The Hyderabad Residency and Ramdas Sen Collections—The collections have been recently added with a number of about 4,000 books and manuscripts in each. The former consists of important official documents while the latter was the private library of the late Ramdas Sen, a reputed Oriental scholar of Murshidabad.

The Library follows its own system of classification formulated on the model of the British Museum Scheme. Books in European languages are catalogued according to the A.L.A. Code. The Library has both printed and card catalogues of which the latter is kept up-to-date.

The most important feature of its activities is the bibliographical information supplied to individuals and institutions in India and abroad. This service is never restricted to the members of the Library. The Library has undertaken the important task of compiling bibliographies of basic books on India and a bibliography of Indian anthropology, which is the first of the series, has just been published and has at once been recognized as a pioneer work in the field.

The Library was housed from 1902 to 1923 in the Metcalfe Hall and then removed to the Foreign and Military Secretariat Buildings, Esplanade East. It has now been shifted to Belvedere, Alipore, and for the first time the Library has a magnificent building of its own in a charming sylvan setting. The Reading Rooms and the Lending Section will, however, continue to be maintained at Esplanade until such time as the Government of India may decide otherwise. By an amendment of the Imperial Library (Indentures Validation) Act I of 1902, the name of the Library was changed from 'Imperial' to 'National' in 1948.

The University Library: The Library of the University of Calcutta is the biggest university library in India. It contains more than two lakhs of printed volumes besides pamphlets and manuscripts. Its humble beginning was made out of an offer of a small gift amounting to Rs. 5,000 from Babu Jaykissen Mukherjee of Uttarpara which was accepted by the Syndicate in July, 1869. About the same time a small collection of books was bequeathed to the University by the will of Babu Eshan Chandra Ghose. In 1874-'75 the Library fund exceeded Rs. 9,000 and the Syndicate appointed a committee to consider the best ways in building up a library stock. On the recommendation of the committee the University purchased European classics, scientific publications and books in Sanskrit, Persian and Arabic languages. The Library continued its humble existence till the passing of the University Act in 1904, in which provision was made for the first time for expenditure on books out of the University fund.

The real start towards the development was, however, made in 1912 with a contribution of Rs. 1,00,000 from the Government of India. But the expansion of the Library became imperative when the University became a teaching body with the opening of the Post-Graduate Department in 1917. This statutory change would not have been of much consequence but for the untiring zeal of Sir Ashutosh Mukhopadhyay, in building up the Library.

The University Library now consists of (*a*) a Central Library in charge of the entire collection of books on literary subjects, mathematics, education as well as general reference work; (*b*) departmental libraries for scientific subjects; (*c*) special collections and Seminar Libraries, particularly for Oriental subjects. The Heads of the respective departments are in charge of the departmental libraries but acquisition of all materials, books, periodicals, manuscripts, rotograph copies, pamphlets, etc., are done through the Central Library.

The libraries of the Applied Mathematics, Applied and Pure Physics, Nuclear Physics, Radio Physics and Electronics, Applied and Pure Chemistry, Physiology, Psychology, Botany, Anthropology and Zoology Departments contain up-to-date standard publications, and taken together they form an excellent science library.

Of the special collections, mention may be made of the Das Gupta, Bagchi, Fine Arts, P. C. Ghose, Pischel and Dunn collections, each of which is remarkable in one way or another.

The number of old Bengali manuscripts in the Library is about 6,200, many of which are extremely rare. Three volumes of descriptive catalogue of these Mss. have been published. The number of Sanskrit and Tibetan manuscripts are 1,054 and 4,859 respectively.

The Library maintains catalogues in cards for all additions since 1937. Dewey's Decimal scheme is used for books in European languages whereas Oriental publications are classified according to a special system. Printed catalogue is also available for a portion of the stock and a consolidated catalogue is under compilation.

The total number of current journals received in the Library is 534.

Besides the University teachers and students the resident registered graduates are also entitled to use the Library.

The Library of the Asiatic Society: The Library of the Asiatic Society of Bengal was established as early as 1784 and now possesses a collection of books and manuscripts invaluable for Oriental studies. This collection can roughly be divided into four sections, namely, General, Sanskritic, Islamic and Sino-Tibetan. There are about one lakh of printed volumes in the Library and the number of manuscripts is not less than 33,000. The number of current periodicals received in the Library is 432. The Library of printed books is particularly rich in scientific and philological serial publications.

In addition to its value as a library for indological and scientific studies it has a rich collection of manuscripts dating from the seventh to the nineteenth century. The number of manuscripts in the Sanskritic languages is about 27,000 representing a wide variety of subjects. There are 6,000 Mss. in the Islamic Section of the Library, some of which bear evidence to show that they belonged to the collections of the Moghul Emperors. The collection of manuscripts was started by donations and legacies from early members of the Society; financial aid from the Governments of India and Bengal led to many more acquisitions.

The task of cataloguing 16,000 Sanskrit manuscripts was begun by Haraprasad Shastri and is yet to be completed. The Persian manuscripts have all been catalogued; the catalogue of Arabic manuscripts is under compilation.

The picturesque collection of Burmese manuscripts and the collection of Tibetan xylographs are also worth mentioning.

Of the special collections, mention may be made of B. C. Law, Charu Chandra Ghosh and R. P. Chanda collections. The Society's Library renders bibliographical services to a large number of institutions and individuals. The two latest bibliographies compiled are those on Buddhism and Tibet.

The Parishad Library: The Parishad's Library has an unrivalled collection of Bengali books and manuscripts. It, however, does not exclude classics in European and other Oriental languages and books on history and culture of India, particularly of Bengal. The Library at present contains more than 50,000 volumes of printed books and about 5,000 manuscripts. This stock has been built up by an amalgamation of several public and private libraries, of which the most important are the libraries of the Bandhab Society, the Sahitya Sabha, Pandit Iswar Chandra Vidyasagar, Poet Satyendranath Dutta, Ramesh Chandra Dutta and others.

The Library has public and private Reading Rooms. The first volume of the printed catalogue of Bengali books has been published and the subsequent volumes are now being compiled. Grants from the Corporation and the Government and readers' subscription are the chief sources of its income.

Scientific Libraries

Compared with other classes of libraries science libraries in Calcutta are generally better managed and equipped. The group of libraries housed in the Indian Museum deserves to be mentioned first. They are the libraries of the Geological, Zoological, Botanical Surveys and Anthropological Department. All these are the departmental libraries of the Government of India.

The Library of the Geological Survey of India, founded in 1856, is the biggest scientific library in India with a total stock of about one lakh of volumes including books and periodicals. The collection is classified according to Dewey's Decimal System, but U.D.C. has recently been adopted. Besides author catalogue a classified catalogue is under compilation; both of them are on cards.

This is a departmental library, but books are issued out for short periods to (*a*) Government departments; (*b*) educational and research bodies; (*c*) colleges, and (*d*) interested persons subject to the approval of the Director, Geological Survey of India.

Besides preparation of bibliographies, as and when required, the Library is responsible for the compilation of annual bibliography on Indian geology and allied subjects which is published in the *Records of the Geological Survey of India.*

The Library of the Zoological Survey of India was formed in 1916 out of the old Indian Museum Library. It claims to contain the largest collection of books on zoological subjects in Asia. The total number of volumes in the Library is 28,459, two-thirds of which are periodicals. Six hundred current journals are received in the Library. A modified Dewey System and A.L.A. Code are followed for classification and cataloguing respectively. The author and subject catalogues are maintained on cards. This is a departmental library but research workers are allowed to use it with the Director's permission.

The Library of the Botanical Survey of India was established in 1896 and today it possesses a stock of more than 35,000 volumes on botany, applied chemistry, travels, dairy farming, art and industry. The number of current journals received in the Library is about 80.

The Library of the Department of Anthropology, Government of India, was established in 1946, and today it claims a stock of 17,000 volumes and 206 current journals. It contains a large number of reprints and pamphlets of anthropological interest. Within this short period of existence its collection has become indispensible for all serious students of Indian anthropology. Brown's Subject Classification is used in a modified form. The Library maintains author and subject catalogues on cards. One of the special features of the Library is that important articles on anthropological subjects, appearing in journals, are indexed under proper subject headings and arranged alphabetically in a separate cabinet.

The Library of the Indian Botanic Garden, Sibpur, established in 1786-'87, claims to be the oldest and best botanic library in Asia. The total number of books and periodicals in the Library today exceeds 25,000. It receives about 80 current journals. The refreshing feature of the Library is that, being housed in the Herbarium buildings of the Indian Botanic Garden, it offers to the student the opportunity for both theoretical and practical study of the subject at the same time.

The Library of the Indian Association for the Cultivation of Science, Jadabpur, was founded in 1876. It has a collection of about 10,000 volumes, including bound periodicals, on natural sciences and natural philosophy, specially on physical sciences. The number of current journals received in the Library is 180. The publications are classified according to Dewey and author and subject catalogues are available. The Library is open to the members of the Association only, but facilities are also offered to other institutions on request.

The Library of the Bose Institute, (93/1, Upper Circular Road), has a small but well-chosen collection on botany, chemistry, physics, zoology and anthropology. 78 current journals are received in the Library. Dewey's classification is followed and the Library maintains a dictionary catalogue on cards.

Besides the libraries of the scientific departments of the University, the libraries of the following institutions and departments are noteworthy: All-India Institute of Hygiene and Public Health; School of Tropical Medicine; Survey of India; Central Glass and Ceramic Research Institute; Chemical Examiner's Office; Medical College; Meteorological Office; Government of India Test House; and of the various Learned Societies.

Special and Technical Libraries

One of the most well equipped libraries in Calcutta is the *Library of the Indian Statistical Institute and Laboratory.* The Library was founded in 1932 and its collection now exceeds 25,000 volumes. The number of current journals which it receives, *viz.,* 710, is perhaps the largest in Calcutta. The Library has its own classification scheme for statistical publications but uses U.D.C. for reprints. The A.L.A. Code is followed for the compilation of the catalogue which is maintained in card form. The services of the microfilm and photostat technician of the Library are lent to other libraries on request. Besides printed books the Library also preserve the manuscript documents of statistical surveys undertaken by the Institute.

To the students of commercial subjects the *Commercial Library* managed by the Department of Commercial Intelligence and Statistics, Government of India, is of great importance. The Library was opened to the public in 1919 and it has today a stock of 24,700 volumes, including periodicals. The number of journals and newspapers received is 411. The membership of the Library is open to the public and books are lent out against deposit.

The three local engineering libraries are the libraries of the College of Engineering and Technology, Jadabpur, Bengal Engineering College, Sibpore, and the Institution of Engineers (India), Bengal Centre, Gokhale Road, Calcutta. Established in 1880, the *Bengal Engineering College Library* is the oldest of the group and has a stock of about 20,000 volumes. The ***Library of the College of Engineering and Technology*** (1906) has a stock of 25,000 books and periodicals. The number of journals subscribed or received as gifts is 120. The U.D.C. is followed for classifying the stock. There are card catalogues in classified and dictionary forms. ***The Library of the Institution of Engineers*** (1924) has a collection of carefully selected books and periodicals. Other libraries of this group, which should be mentioned here, are the libraries of the Bengal Chamber of Commerce, Department of Industries (W. B. Govt.), Indian Central Jute Committee, Telegraph Storeyard (Alipore), Patent Office, etc.

College Libraries

There are more than thirty colleges in Calcutta. Some of the old colleges possess valuable stocks of books and publications. The Library of the Presidency College is perhaps the biggest college library in the country. It has a collection of more than 60,000 publications, all properly classified and catalogued. The Library of the Sanskrit College is very rich in Sanskritic and allied subjects. It possesses books and manuscripts which are not available elsewhere. The Library of the St. Xavier's College has a stock of more than 30,000 volumes of which the most remarkable is the Goethals collection bequeathed to the College by the late Dr. P. Goethals, Archbishop of Calcutta. The Library of the University Law College forms a unique collection of law books. The David Hare Training College Library has made a remarkable neat collection of books on the principles of education.

Public Libraries

There are about 250 public libraries in Calcutta and they present a strange variety. The stock of these libraries ranges usually from 500 to 30,000; some are as old as 75 years while others are of recent origin. But one thing is clear that their development, technical and material, is not as it should be. This is mainly due to their financial disability. In the absence of any Library Act they are dependent on the membership subscription which is never satisfactory. The Library grant of the Corporation for the year 1951-'52 is only Rs. 42,000. Even this sum is not shared by all.

Most of the libraries are housed in rented premises. The libraries remain open for a couple of hours in the morning and in the evening. It is obligatory on the part of the recipients of the Corporation grant to maintain a free reading room. During the past decade the Children's Sections of these libraries have become extremely popular. The major portion of the stock is naturally formed out of the Bengali books of light reading, but some old libraries possess books and periodicals which are valuable records of Bengal's history and culture.

Of the numerous libraries of this category the following may be mentioned: Ashutosh Memorial Library; Baghbazar Reading Library; Chaitanya Library; Rajani Kanta Gupta Memorial Library; Rammohan Library; Taltala Public Library; United Reading Rooms, etc.

The Library of the Ramakrishna Mission Institute of Culture, Russa Road, is the biggest public library with a stock of one lakh of valuable books on all important subjects.

Miscellaneous Libraries

The W. B. Secretariat and Legislative Assembly Libraries, though purely departmental, contain valuable government documents. The libraries of the Gaudiya Math, Mahabodhi Society, Sadharan Brahmo Samaj, etc., are important for the study of philosophy and religion. The libraries of the Sanskrit Sahitya Parishad, Bengal Library Association, and the Judges Library, High Court, are worth mentioning. The two best club libraries of the city are those of the Bengal and Calcutta Clubs. One of the best art collection in the city is that of the Art Section, Indian Museum. The libraries of the British Council, Theatre Road, and U.S. Information Service, Esplanade, have become popular for their up-to-date reference collection and efficient service.

Conclusion

We have seen that many important libraries of the city are either departmental or institutional. But this fact does not usually hamper the studies of a *bona fide* student not connected with them. All the libraries are helpful. The difficulty lies elsewhere. The materials are so widely spread among the different libraries that the scholar often fails to have a comprehensive idea about the resources available on the subject locally. To remove this difficulty, a sort of Union Catalogue of important subjects is needed. The only tangible effort in this direction was the 'Catalogue of the Scientific Serial Publications in the Principal Libraries of Calcutta' (1918) compiled for the Asiatic Society of Bengal by Mr. S. W. Kemp.

To further the cause of research and learning a better spirit of co-operation among the local libraries should be fostered. The system of inter-library loan, which is in vogue on a very restricted scale, should be more liberally utilized. The formation of a Calcutta Library Association would be the first step towards the realization of these ideals.

SECTION IV

SURVEYS, GOVERNMENT RESEARCH ESTABLISHMENTS AND LABORATORIES UNDER INDUSTRIAL ORGANIZATIONS

Survey of India

THE first authoritative map of India was published by D'Anville in 1752, when the exploration of the then unknown India was still largely in French hands. It had been compiled from routes of solitary travellers and rough charts of the coast.

The Survey of India may be said to have been founded in 1767, ten years after the battle of Plassey, when Lord Clive formally appointed Major James Rennell as the first Surveyor General of Bengal, at that time the most important of the East India Company's possessions. Rennell's maps were at first military reconnaissances and latterly chained surveys based on astronomically fixed points, and these do not pretend to the accuracy of the modern maps of India based on the rigid system of triangulation commenced at Madras in 1802 and since extended over and beyond India. Even now, however, the relative accuracy of these old maps makes them valuable in legal disputes. From these beginnings, this department has gradually become primarily responsible for all topographical surveys of India and its neighbouring areas and for the maintenance of geographical maps of the greater part of Southern Asia, and also for geodetic work.

Geodetic Work

Geodesy means the investigation of the size, shape and structure of the earth, and the geodetic work of the department consists of primary (or geodetic) triangulation, latitude, longitude and gravity determinations. From these the exact "figure" of the earth is obtained, whereby points fixed by triangulation can be accurately located on its curved surface. This system of fixed points holds together all topographical and revenue surveys, and the existence of such a system from the early days of the department has avoided the embarassments caused in other countries where isolated topographical surveys have been started without a rigid framework, with the inevitable result that these later on could not be fitted together.

A geodetic framework is essential for the survey of any large areas, but there are a number of other activities, all of them ultimately utilitarian, which can be suitably combined with it, and the following are some of those which have been carried out in India:

(*i*) Precise levelling for the determination of heights;
(*ii*) Tidal predictions and publication of Tide-Tables for the main ports in the Indian Ocean;
(*iii*) The magnetic survey;
(*iv*) Observation of the direction and force of gravity;
(*v*) Astronomical observations to determine latitude, longitude and time: and
(*vi*) Seismographic and meteorological observations at Dehra Dūn.

Topographical Surveys

In the past this department used to carry out the large scale revenue surveys for most of India, and still conducted this work for Central and Eastern India and Burma up to 1905. By 1905, however, the small scale topographical surveys compiled from the large scale revenue maps had fallen seriously in arrears. An authoritative Survey Committee appointed by the Government of India considered the position in 1905, and it was decided that the remaining revenue surveys should be handed over to the provinces, and the Survey of India would thus be able to concentrate its energies on a complete new series of modern topographical maps in several colours on the 1-inch to 1-mile scale.

It was intended that the survey begun in 1905 should be completed in twenty-five years, and then revised periodically every thirty years. Owing, however, to the World War and more recent retrenchments, only about three-fourths of the programme had been completed by 1939, in spite of a reduction of scale for the less important areas. Owing to the serious financial situation in 1931, the establishment of the department was drastically reduced and its annual expenditure halved.

Although from 1905 to 1939 new surveys were carried out every year, covering annually from thirty to sixty thousand square miles—an area roughly that of

England and, the maps of a large part of the country are still over 50 years old, printed mostly in black only, and have hill features shown by roughly sketched form lines or hachures. During the 1939-1945 war, topographical survey work in India practically ceased, and since the conclusion of hostilities the main efforts of the department have been directed to large scale surveys for utilitarian purposes, such as surveys for irrigation and hydro-electric projects, so that no appreciable progress has been made since 1939 in the 1905 topographical programme.

Large Scale Survey

Surveys and records of international, state and provincial boundaries have always formed an important item of topographical work, and in recent years a number of Guide Maps have been published of important cities and military stations usually on scales of about 3 inches to the mile.

Miscellaneous

So far as work for the Central Government will permit, this department undertakes local surveys on payment for provinces, states, municipal and other local authorities and private firms, and will give advice as to the methods to be employed on such work. Surveys of the above description include forest and cantonment surveys, riverain and irrigation surveys, railway and city surveys, and surveys of tea gardens and mining areas. The department is also equipped to carry out lithographic printing and can undertake such work on payment.

Air Survey

The use of air photographs for survey purposes has become a normal practice and air survey is employed wherever it is considered advantageous to do so. The Survey of India has arranged with a company in India for the supply, on contract rates, of such photographs as it may require for survey purposes.

Civil Aviation

With the establishment of an International Civil Aviation Organization, charts on varying scales to a uniform specification have been planned to cover the whole world. In the case of India, our commitments are:

(*i*) Charts on the 1:1,000,000 scale—23 in number;

(*ii*) Instrument Approach Charts on the scale 1:250,000, and Landing Charts on the scale of 1:50,000, of all the important civil aerodromes in the country; and

(*iii*) Charts on the 1:500,000 and 1:250,000 scales, Route Charts and various Plotting and Planning Charts.

Administration

The administration of the Survey of India is in the hands of the Surveyor General of India under the Ministry of Food and Agriculture, Government of

India. The headquarters office of the Surveyor-General of India is at present at Mussoorie. There are four Directors and Survey Circles in addition to a Director of Map Publication as under:

Director, Northern Circle, Headquarters—Dehra Dūn. Director, Eastern Circle, Headquarters—Shillong. Director, Southern Circle, Headquarters—Bangalore.	Responsible for all topographical and large scale surveys within their area of responsibility.
Director, Geodetic and Training Circle, Headquarters—Dehra Dūn.	Responsible for the geophysical and mathematical activities of the department and for training.

The Director, Map Publication, Headquarters—Dehra Dun, is responsible for all the map publication activities of the department.

Geological Survey of India

THE first record of geological work in India is by H. W. Voysey in 1820, who prepared a geological map of the Hyderabad region and this was followed for some years by sporadic work by a few other Europeans in their individual capacity. The next development was the coming into being of a committee for the investigation of the coal and mineral resources of India in 1837, and it is in connection with the work of this committee that the first mention of the title 'Geological Survey of India', although used unofficially, was made. However, the Geological Survey of India, with its proper role as a scientific organization, was established in 1851 under the charge of Thomas Oldham, and it was not until 1877 that a geological map of India was published on scale 1 inch = 64 miles. It took a few years before the Survey could start functioning efficiently. From 1856 onward till Oldham's retirement in 1876, its history was one of steady growth, and it was during this period that the work of the pioneers laid the foundations of our knowledge of Indian geology. The staff increased, laboratories were established, the surveys systematized and the reports began to be published in a uniform series. An Annual Report, which was later merged in Part I of the *Records* of the Geological Survey of India, was published in 1858-59. The *Memoirs* of the Geological Survey of India, containing reports on different districts in one uniform series, were inaugurated in 1856 and the *Palaeontologia Indica* in 1861. An important development in 1858 was the integration of the Geological Museum of the Asiatic Society of Bengal with the Geological Survey of India, which has grown during subsequent years into one of the most important institutions of its kind in the East.

One of the most significant contributions of the Geological Survey of India to Indian and world geology has been the ascription of the origin of the Talchir boulder-beds to ice action by W. T. and H. F. Blanford, and Theobald and their correlation of the same with similar formations in Australia, Brazil and South Africa. This and the subsequent study of the Gondwana Plant fossils and Triassic Vertebrates laid the foundation of the modern conception of Gondwana-Land as a great southern continent and thus played a vital role in the development of the theories of continental drift.

The surveys of H. B. Medlicott and C. S. Middlemiss in the Himalayas, and later, of G. E. Pilgrim, W. D. West, D. N. Wadia, and J. B. Auden have thrown considerable light on the geology and structural features of this great and complex mountain system. C. L. Griesbach's work in Spiti, Wynne's survey of the Punjab Salt Range and F. R. Mallet's work in Eastern Himalayas are important scientific achievements. The correlation of the marine formations of the Himalayas with those of Europe led to the conception of the Tethys sea. H. H. Hayden was the pioneer in the study of the Himalayan glaciology and the study of the great Assam earthquake by R. D. Oldham in 1897 brought about the discovery of main types of earthquake waves.

The contributions of the members of the Geological Survey of India have been no less important in the study of the crystalline igneous and metamorphic rocks of the Peninsular India. The discovery of a petrographic province of hypersthene-bearing granitoid rocks in Madras Province by Thomas Holland, known as the Charnockite series is an outstanding early example. Subsequently P. K. Ghosh investigated the Charnockite rocks of Bastar and Koraput and put forward new ideas as to their origin. Study of Khondalites and Kodurites of known as the Charnockite series is an outstanding early example. Subsequently, H. C. Jones, J. A. Dunn and M. S. Krishnan on the Dharwars of Singhbhum and the adjoining areas are some of the other important examples.

In the field of palaeontology mention must be made of H. Warth's discovery of Cambrian trilobites in the Punjab Salt Range, F. Stoliczka's classification of the fossiliferous formations of the Upper Sutlej and Spiti Valleys, and his and H. F. Blanford's researches on the Cretaceous fossils from Trichinopoly in southern India. H. Falconer and P. T. Cautley are credited with the discovery of Siwalik vertebrate fossils between 1835 and 1845, but Indian vertebrate palaeontology was subsequently greatly developed by R. Leydekker and G. E. Pilgrim. The work of Pilgrim contributed greatly to the knowledge of stratigraphy and structural geology of the Punjab Himalayas, thus paving the way for recent workers to locate possible oil-bearing structures in the area. Pilgrim and E. H. Pascoe also carried out important studies on the geology of the great oil producing regions of the Persian Gulf.

It was recognized quite early that the knowledge and distribution of geological formations and the basic structures is fundamental to any sound study of the mineral resources of the country. Therefore, as the basic knowledge of the geology progressed, the study of the mineral resources also expanded progressively. The first to receive attention were the coalfields of India. Many of these have already been surveyed in detail and are being exploited on a large scale. The discovery of iron ore deposits in Mayurbhanj by P. N. Bose in 1880 led to the establishment of Indian iron and steel industry and subsequently further large scale reserves of high grade iron ores have been proved in Singhbhum, Madhya Pradesh and Mysore. L. L. Fermor's examination of the manganese ore deposits of India, apart from economic results, led to his description of a large number of new minerals. The survey of mineral resources has shown that India possesses within her domain adequate reserves of coal, iron and the metals required for ferro-alloys which are the basis of modern industrialization and power.

The role of the Geological Survey of India in promoting the economic development of the country is very fundamental—it plays an important part in the development of its mineral resources and the main sources of power. It discharges these primary functions in a variety of ways. The department is engaged in the preparation of reliable geological maps which are the basis for the search for and proper exploitation of mineral deposits and underground water, for the selection of dam sites and for the delimitation of the earthquake zones. The next stage is the determination of reserves of minerals of economic importance and detailed exploration of deposits by geophysical methods and by drilling and exploratory mining. The department is closely collaborating with other organizations in the field of mineral, water and power development. It is well equipped for carrying out chemical and petrographical determination of minerals, ores, coal, oil, gas, etc. and for palaeontological and palaeobotanical determination of fossils of value in the correlation of coal and oil-bearing strata. Although in the present circumstances there is bound to be great emphasis on the economic application of geology, the pursuit of its scientific and cultural aspects is not being neglected.

The work of the Geological Survey of India is now organized on the basis of three main divisions. The first division consists of Field Circles which are responsible for the detailed mapping of the country and for all preliminary investigations of mineral deposits or of ground water and engineering problems. The second division consists of technical sections maintained at the Calcutta Headquarters comprising the petrological, chemical, palaeontological and palaeobotanical sections, the geophysical workshop and the drawing office, together with the mineral information bureau, the statistical section and the sections responsible for the general administration. The third division consists of the specialist sections which are available for work in any part of India. These sections are responsible for advanced studies in engineering geology and groundwater, and for the detailed examination of mineral deposits by geophysical methods and drilling or exploratory mining.

Prior to World War II, the department consisted of barely 30 officers. During the war it was expanded and had 65 officers in 1944. A plan for further expansion was decided upon by the Government of India in 1945 and a Five Year Plan drawn up and published in 1946 contemplated the expansion of the activities of the department and its personnel to 141 officers. That target has already been attained and a new Five Year Plan for further expansion has been drawn up. The war also saw the conversion of the composition of the Geological Survey of India from the overwhelmingly European scientific personnel to mainly Indian personnel and the process of Indianization was consummated in 1951 when a distinguished Indian geologist, Dr. M. S. Krishnan, became the Head of the Department. The Geological Survey of India has completed a century of its existence and its Centenary was celebrated in January last year. It has already made a name amongst the great scientific organizations of the world and looks confidently ahead to even greater achievements in the future.

Alipore Meteorological Office and Observatory

THE Alipore Observatory is one of the few oldest scientific institutions of India. The observatory is located in a fairly spacious compound by the side of the Zoological Gardens in the Duel Avenue at Alipore. Besides all types of modern meteorological instruments, the observatory has many rare and old instruments which are of historical importance. For instance, the standard barometer of this observatory is being used for a long time for standardizing the barometers in use in India as well as some of the neighbouring countries. Again, the observatory's Knudsen barograph is one of the very rare meteorological instruments, probably the only of its type used in Asia.

Before 1867, interest in meteorology in India was mainly confined to the recording of meteorological observations by individual interests. In Calcutta, however, the systematic recording of observations began in 1853 at the Survey Office in Park Street. Real interest in the meteorology of India in general and of Bengal in particular was aroused after the great disaster caused by the Great Calcutta Cyclone of 1864 which was responsible not only for a considerable damage to property and to shipping but also for the loss of over 80,000 human lives. As a consequence, five Provincial systems of observatories were evolved during the period 1865-1874, the one for Bengal coming into being in 1867 under the Reportership of Mr. H. F. Blanford, the then Professor of Natural Science in the Presidency College, with twofold functions of issuing cyclone warnings for the protection of shipping and collecting and recording systematic meteorological observations throughout the Presidency. This new organization earned a very high position for itself in the scientific world and in a short time became well known for the accuracy of its data and the thoroughness of its work.

In 1866, an Enquiry Commission was set up by the Government of India and the Secretary of State to investigate into the causes of the Orissa and Bengal Famine of the year. As a result of the recommendations made by this Commission, it was decided to reorganize and extend the work of the meteorological organization and establish an organization not only confined to the Presidency but for the whole of India. Accordingly, in July, 1875, the present India Meteorological Department was instituted to co-ordinate, combine and extend the work of the various Provincial organizations. The Alipore Observatory came into existence at the present site in 1875 as one of the initial items of this scheme. The functions of the observatory were not only confined to the systematic recording of observations of various meteorological elements and of maintaining autographic instruments for this purpose but also included its acting as a central depot for the calibration of instruments for supply to other observatories and as a training ground for observers. Experimental observations and special investigations were also a part of the observatory's programme of pioneer work which commenced in 1867. After the establishment of this institution, observations at the Survey Office were stopped.

In order to originate cyclone warnings for the protection of the shipping, preparation of daily weather charts at Calcutta was started in 1877, when the Meteorological Office at Alipore began to collect daily reports by post. This system, however, failed as it lacked the quickness to give correct information in time to the public or the efficiency to serve the daily forecasting purposes due to the long delay inevitable under this mode of communication in the completion of the weather charts. After the draughts and the famine of 1876 and 1877, the Government's anxiety for the earliest possible information about the progress of monsoon of 1878 led in July that year to the reception of meteorological observations from outside stations by telegrams for the purpose of quick publication of the daily weather reports and forecasts. In 1881, the issue of the telegraphic weather summary was introduced to co-ordinate and to circulate the information throughout the country. In the very same year the storm warning signal service for the benefit of shipping was initiated at Calcutta for the Bengal coast. After a series of floods in 1869, the Meteorological Service was extended to the issue of inland warnings to a large number of P.W.D. and other interests against heavy rainfall and floods.

The meteorological organization at Calcutta, in addition to the above items of work, was also responsible for the determination of correct time by taking transit observations of stars and issuing time signals for shipping, the telegraph offices and the public. It had also been maintaining seismographs from 1905 to record earthquake shocks.

With the expansion of the India Meteorological Department, the meteorological organization at Alipore has grown considerably and its activities have multiplied manifold. Alipore Observatory is now a part of the expanded organization of India Meteorological Department and at present the Meteorological Office at Alipore is the seat of the Director, Regional Meteorological Centre, Calcutta, comprising of West Bengal, Bihar, Orissa and Assam and the Andamans. This office is now responsible for the meteorological organization over this region and has to render meteorological service to aviation—civil and military, shipping—navy and mercantile, ports and administrative authorities, agriculture and forestry, irrigation, public works, railways, medical and health services and the general public including commercial bodies. As hitherto, this office is also responsible for the determination of correct time and issue of time signals to shipping by wireless broadcast and to telegraph offices by landline and also for seismological work.

GEOLOGICAL SURVEY OF INDIA

PHYSICAL ANTHROPOLOGY LABORATORY, DEPARTMENT OF ANTHROPOLOGY, GOVERNMENT OF INDIA

Department of Archaeology

IN 1860 the Government of India decided to start an Archæological Survey of India 'to make an accurate description of such remains as most deserve notice, with the history of them so far as it is traceable and a record of the traditions that are retained regarding them' and appointed Sir Alexander Cunningham the Archæological Surveyor. During the four years (1862-65) that he held office, Cunningham visited and reported on a large number of monuments and remains in the north-western Province (present U.P.) and Bihar.

The Survey was held in abeyance for the next five years, after which, in 1870, it was re-started with Cunningham as its first Director-General. During the next fifteen years, Cunningham, with the help of three assistants, surveyed the whole of North India. His twentytwo-volume report embodies the results of an extensively planned survey and in many respects remains unsurpassed even now.

To accomplish what was being done by Cunningham in North India, Dr. James Burgess was appointed Surveyor for Bombay and Madras in 1874. In addition, Major H. H. Cole was appointed Curator of Ancient Monuments in 1881 'to superintend, under the Supreme Government, the conservation of the most celebrated and important examples of national archæology and architecture'. Though Cole could retain his position only for four years, his appointment carried with it the recognition of the principle of State responsibility for the preservation of the material heritage of India.

Burgess succeeded Cunningham in 1885, but only to retire in 1889. In that year the post of Director-General was retrenched and only a few provinces were lucky enough to retain the services of Surveyors. An important post, that of the Government Epigraphist, was created in 1890, but the object was 'to bring archæological work to a termination within a reasonable time.'

In 1895 Government decided that the Survey could not be disbanded altogether, but declared simultaneously that it should confine its activities to conservation alone. India was divided into five conservation-circles, each under a Surveyor, responsible for his work to the Provincial Governments, which were to finance all conservation-projects.

The scheme was put into operation in 1899, but Lord Curzon, who had more liberal ideas about archæology, had already arrived as Viceroy. He declared that the preservation of monuments could not be left to the vagaries of Provincial Governments but should be the responsibility of the Centre, and that it was 'equally our duty to dig and discover, to classify, reproduce and describe, to copy and decipher and to cherish and conserve',—thus laying down virtually the same functions for the Archæological Survey as it is even now concerned with, *viz.*, exploration, publication, epigraphy and conservation. The renewed appointment of a Director-General was a natural outcome of this assumption of increased responsibilities, and Mr. (later on Sir) John Marshall took charge of the revived post in 1902. Another landmark in the history of Indian archæology was the passing in 1904 of the Ancient Monuments Preservation Act, which, *inter* *alia*, empowered Government to 'protect' monuments with a view to preventing damages being done to them.

With each subsequent Government of India Act, the Centre assumed greater control over archæology, till the 1935 Act took away from the Provinces whatever power had been left with them. The present Constitution of India, however, makes a distinction among historical monuments and ancient sites and remains (which are to remain with the Centre), historical buildings of local interest (which are relegated to the States) and ancient sites and remains of local importance (which are included in the concurrent list). How this division of functions will work remains to be seen.

After the re-organization of the Department in 1902, some of the progressive Indian States started their own archæological organizations which acted independently of the Central Department. With the integration of India these organizations will have to make over the monuments of national importance in their charge to the Centre.

We may leave here the constitutional position of official archæology in India and turn to the work of Archæological Survey.[1] With its stability assured from 1902, the Survey has done immense work in all archæological fields in spite of financial limitations. In its early days much attention was paid to the repairs of, to name only a few of a vast list, the important monuments at Delhi, Lahore, Agra, Fatehpur Sīkrī, Sānchī, Mount Abu, Māṇḍu and Rohtās. In recent days the chief monuments that have claimed our attention are the Tāj Maḥal, those at Fatehpur Sīkrī, the Gol Gumbad at Bijāpur, Elephanta, Mahābalipuram and Konārak. The Department has no less than three thousand items on its list of protected monuments, and most of them receive their share in the annual repair programme of the Department and in addition are given special attention whenever necessary. The Chemical Branch deals with problems connected with the deterioration of stone due to natural factors and preservation of mural paintings, in addition to treatment of antiquities and analysis of ancient material.

The exploration activities of the Department were generally confined in its earlier days to Buddhistic sites in North India, though a few important city-sites were also excavated. With the discovery of Harappā and Mohenjo-daro in the early twenties, which, 'at a single bound, took the knowledge of Indian archæology some 3,000 years earlier', a re-orientation of the policy was necessary and large-scale explorations of Baluchistan and Sind were undertaken to establish the regional and chronological links of the Harappā civilization. Patient field work is still necessary to fill in the gaps between the proto-historic and historical periods. In South India two recent excavations have resulted, in one case, in the discovery of Roman antiquities, and, in the other, in the dating for the first time of a group of megalithic monuments which abound in South India.

The Epigraphical Branch copies and publishes hundreds of inscriptions from all over India every year and thus supplies to historians material for the history of India.

Apart from the local museums at such excavated sites as Sārnāth, Nālandā and Nāgārjunikoṇḍa, the Department maintains the Archæological Section of the Indian Museum, Calcutta, and the Central Asian Antiquities Museum, New Delhi. Pending the establishment of a full-fledged National Museum of India, a nucleus of the Museum, containing a limited collection of antiquities and art-objects is functioning at New Delhi under the auspices of the Department.

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[1] Renamed 'Department of Archaeology' in 1948.

Post and Telegraph Workshops, Alipore

THE Ministry of Communications, Government of India, operates four workshops for the manufacture of telegraph and telephone equipment. The Alipore Workshop is one of them.

The main building of the Workshops was constructed somewhere around 1860. The building was primarily designed to house a telecommunications repair and maintenance shop to meet all India needs, including Burma. The Workshops were then under the direct command of the Commandant at Fort William. In 1910, the first type of magneto switchboards were assembled in this factory from the components imported from U.K. The manufacture of minor components for Baudot and Line Stores was first initiated in this Workshop in 1913.

With the advent of the World War I and expansion of telephone and telegraph facilities, manufacture of a few small parts urgently needed for telegraphs and telephones was undertaken. Serious efforts in the direction of manufacturing various items which could not be procured from England were first made in the Workshop during World War I. This impetus made it possible for the Workshop to include in its manufacture many components for instruments, telephone switchboards and considerable number of telephone parts. At the close of World War I the shops were manufacturing all components for Baudot and Morse instruments.

In the late 'thirties, there was a scarcity of telephone parts and in anticipation of a world war, the Government of India undertook in earnest the manufacture of telephones, switchboards and telegraphs—both high speed and Morse. Since then the Workshop has been manufacturing practically all components for telegraphs and manual telephones.

Alipore Workshops at present manufacture manual telephones, cable terminals, instrument cords, telephone and telegraph instruments and practically all the minor items of line construction stores. The Workshops are also manufacturing magneto switchboards, trunk boards T-32 pattern, C.B. multiple switchboards—both A and B positions, test positions, monitoring positions, C.B. non-multiple switchboards, private call office cabinets, charging boards, phonogram equipment, V.F.T. repeaters racks, balancing box for telegraph, electrical measuring instruments like ammeter, volt-meter, galvanometer, wheatstone bridge, G.P.O. relays, sounders and cross-talk meters with tone box including their components.

Repair of telephone and telegraph instruments constitutes a substantial share of the work in the Workshops. All the teleprinters used in the P. & T. establishments in India are repaired here. The Workshops' personnel consist of

23 technical staff, 289 ministerial and other staff, and 2,060 industrial workers, making a total of 2,372.

The Workshop provides canteen facilities for the staff. A full time doctor attends to the medical needs of the Workshops' personnel. A co-operative society caters to the needs of the workers by providing consumers articles of good quality at minimum price. Recently in-shop training work has been introduced to impart technical knowledge to the workers.

Botanical Survey of India

THE Botanical Survey of India, now a department under the Ministry of Food and Agriculture, Government of India, was constituted in the year 1890 with its headquarters in the Royal (now Indian) Botanic Garden, Calcutta and with the Superintendent of the said garden as its *ex-officio* Director. It was established primarily for the floristic survey of the provinces of Bengal, Burma, Assam and the Islands in the Indian Ocean. The activities included floristic and ecological surveys, collection, classification, naming and preservation of plant specimens in the herbarium for future references in systematic, taxonomic and such co-ordinated branches of botany, as agriculture, horticulture, forestry, pharmacognosy, pharmacology, and on medicinal, poisonous and insect repellant plants belonging to all classes of Plant Kingdom.

Liaison officers at Madras, Bombay were also appointed to carry out the survey work in those provinces and submit their reports to the Director at Sibpur for consolidation and submission to the Government. The Botanical Department, Northern India, with its headquarters at Saharanpur was also attached to the centre at Sibpur. The provinces of Bengal, Assam and Burma contributed funds equally with that of the Centre for carrying out this work. The northern India Botany Department was abolished on the retirement of J. F. Duthie in 1902 and the co-operation of the liaison officers became gradually broken up as the economic botanist's departments of the provinces were developed.

The director at Sibpur alone continued the survey work for sometime, and in 1908 on the recommendation of the Board of Scientific Advice, a small staff consisting of a gazetted assistant, a photographer, and a clerk was added. In 1912 the offices of the Reporter on Economic Products to the Government of India and that of the Curator of the Industrial Section, Indian Museum, Calcutta were amalgamated with that of the Botanical Survey of India and placed under the Director. The activities of the Survey since then related to (1) the care and improvement of the Industrial Section of the Indian Museum, (2) collection and record of information on all economic plants, excluding agricultural crop plants and forests, (3) purely scientific work on systematic botany. The exhibits of economic products in the Indian Museum, the herbarium and the library form the materials for the study of the economic botany of India. Periodically contributions on economic plants are published from this section.

The systematic section, after many vicissitudes, regarding staff, funds etc., now consists of a solitary assistant, whose work is supervised by the Superintendent, Indian Botanic Garden, who is in charge of the systematic section of the Botanical Survey of India and its other interests in the Sibpur Herbarium since 1938 when the last Director retired and the post was kept in abeyance. The activities of the Survey are now mainly confined to herbarium work and answering of enquiries on scientific and economic questions and some floristic work as far as funds permit. Several parts of India have been surveyed floristically and the collections which have accumulated from 1890 onwards have been very useful in the preparation of the flora of Madras, Bombay, Assam, Behar and Orissa, and Upper Gangetic Plain. The official publication of the Survey is the *Records* of the Botanical Survey of India; the first issue appeared in 1893 and Vol. XV, (Parts I & II) 1949 has come out so far. Besides publication in the *Records*, the results of researches by the staff are published in various other journals elsewhere also. It is hoped that the re-organization of this Survey will be taken up by the Ministry of Agriculture, Government of India from 1952 as soon as funds permit.

Government Test House, Alipore

THE Government Test House, Alipore, which has been a product of the industrial renaissance of the country was started 39 years ago originally for testing engineering stores on behalf of the state railways. It has developed in gradual stages to a busy technical testing organization to cope with the requirements of the government purchase and supply departments, the growing Indian industries and large public and private concerns. It is at present controlled by the Ministry of Works, Production and Supply, Government of India, through the Director General of Supplies and Disposals and is the only governmental institution on the civil side, where tests on industrial and commercial goods are undertaken on a commercial basis and test certificates are issued on the materials tested.

The activities of the Test House cover a wide range and its main activities can be summarized as follows:

(1) Testing of industrial, commercial and engineering materials, raw, semi-finished and finished on behalf of private individuals and firms, public bodies and government departments including law-courts and police and issue of test certificates on the quality of the samples tested;

(2) Drawing up of specifications and furnishing of technical information;

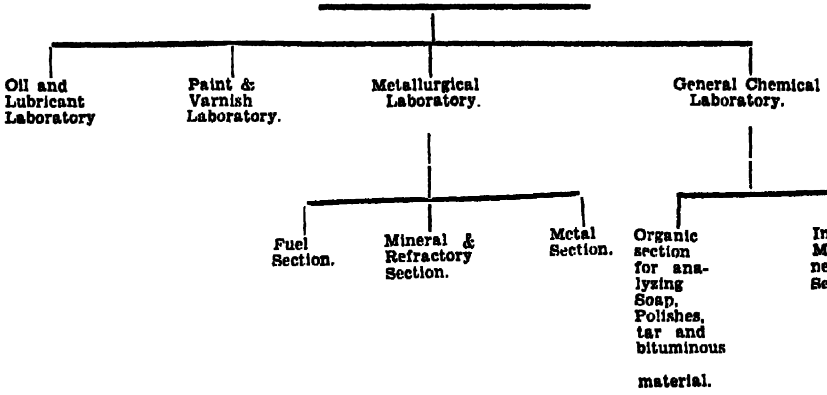
(3) Helping Indian industries as far as possible with technical information and advice required for the utilization and refining of indigenous raw materials and improving their manufactured products; and

(4) Investigation into the causes of failures or unsatisfactory behaviour of materials in service.

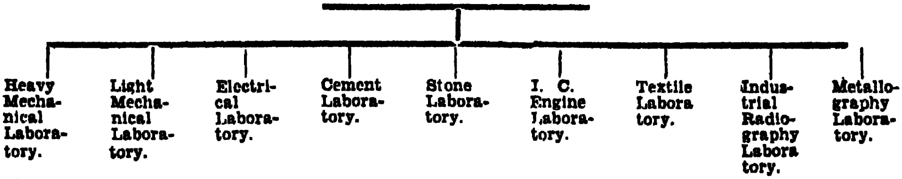
In the past considerable prejudice seemed to have existed against Indian manufacturers and their products in certain quarters, and this prejudice could not be removed except on the basis of practical tests. The Test House has consistently been recommending the purchase of those Indian products which are good, and at the same time, it has helped to raise the general level of quality by rejecting products which do not conform to the recognized standards as well as by offering constructive criticism wherever possible. Materials are tested to any recognized standard specification such as those of the British Standard Institution, Indian Standards Institution, Directorate General of Supplies and Disposals, American Society for Testing Materials, British Pharmacopoeia, Indian Telegraph Department, Indian Railways, etc. or to any other specifications as desired by the manufacturer or purchaser.

The Test House is divided into two departments, chemical and physical, which are again sub-divided into the following laboratories and sections as shown below:

A. CHEMICAL DEPARTMENT


Oil and Lubricant Laboratory
Paint & Varnish Laboratory.
Metallurgical Laboratory.
General Chemical Laboratory.
Fuel Section.
Mineral & Refractory Section.
Metal Section.
Organic section for analyzing Soap, Polishes, tar and bituminous material.
Inorganic Miscellaneous Section.

B. PHYSICAL DEPARTMENT


Heavy Mechanical Laboratory.
Light Mechanical Laboratory.
Electrical Laboratory.
Cement Laboratory.
Stone Laboratory.
I. C. Engine Laboratory.
Textile Laboratory.
Industrial Radiography Laboratory.
Metallography Laboratory.

The need for expanding these laboratories and equipping them reasonably up-to-date consistent with the increasing demands of industry and commerce has of late been realized, and the Government of India have constituted an Advisory Body consisting of eminent scientists, engineers and industrialists to explore the possibilities of modernization and expansion. It is anticipated that the schemes approved by the Advisory Body will materialize in the near future and this establishment will be in a better position to maintain its tradition for the development of the industry of India.

Zoological Survey of India

ON July 1, 1916, the Zoological and Anthropological Section of the Indian Museum was given the status of a Government Scientific Survey Department under the title of the Zoological Survey of India. Its history can, however, be traced back to 1814, when the Asiatic Society set up a Museum in its premises at 1, Park Street, Calcutta. The Survey was established to perform *inter alia* the following functions:

(1) To undertake faunistic surveys in order to acquire knowledge about the variety and geographical distribution of the Indian fauna;

(2) To maintain and look after the national zoological collections;

(3) To maintain and improve the zoological public galleries of the Indian Museum;

(4) To act as a bureau of information on systematic zoology; and

(5) To act as adviser to Government on all matters connected with the science of zoology.

Having been established in the middle of the World War I, it has had no chance so far to grow to its proper stature, but efforts are now being made to resuscitate it, especially in view of its great importance to such applied sciences as agriculture, veterinary, fisheries, medicine and public health.

As systematic zoology, zoogeography, fisheries and animal ecology are not taught in any university in India, the Zoological Survey of India has been affording opportunities to advanced students from all over the country to work on these subjects in its laboratories for research degrees. In recent years, several students have qualified for D.Sc., Ph.D. and M.Sc. research degrees and three Research Fellows of the National Institute of Sciences of India are now working in its laboratories. Enquiries are received from the zoological departments of the universities, institutions interested in the application of zoological knowledge to practical problems, and from sportsmen and general public. By supplying them all with relevant information, the Survey is disseminating zoological knowledge fairly wide. It helps in organizing zoological exhibitions for the same purpose.

The Zoological Survey of India publishes two journals of systematic zoology, the *Records and Memoirs of the Indian Museum*, and is now also responsible for the publication of the *Fauna of India*. It also issues a *Triennial Report* of its activities. These publications were suspended during the war but have now been revived and efforts are being made to bring them up-to-date. The Zoological Public Galleries of the Indian Museum suffered heavy damage during the military occupation of the Museum during World War II and since 1947 efforts are being made to restore and reconstruct them.

The greatest value of the Zoological Survey of India lies in its rich zoological collections of all groups of Indian animals and in its very extensive zoological library. Books and specimens are lent out to *bona fide* students of zoology in India and sometimes to outside countries also. This procedure enables zoological research to be conducted in all parts of the country. Help of outside specialists is invited to work out certain collections while the specialists in the Survey render similar help to other countries.

The World War II also had its baneful effects on the Zoological Survey of India. To save its library and spirit collections, the Survey was transferred to Banaras in April, 1942. In 1943, its collections and library suffered heavy damage owing to floods in the Varuna River. The damage, though considerable, has not yet been properly assessed. The Survey shifted back to Calcutta in 1949, but only a small space could be allotted to it in the Indian Museum, with the result that most of the spirit collections, the offices and laboratories of the Survey are now located in the Jabakusum House at 34, Chittaranjan Avenue. Only the library, the mammals and birds section and the section dealing with zoological public galleries are now in the Indian Museum.

The technical work of the Survey is at present conducted under seven sections: mammals and birds; reptilia and batrachia; fishes; insects; molluscs; crustacea and other invertebrates. Each section is under the charge of an officer who is assisted by a scientific assistant in looking after the collections.

The Survey is thus an institution of fundamental zoological research and, though its direct usefulness may not be known to the general public, its role in helping applied sciences in alleviating human suffering is very great and its functions are, therefore, of great national importance.

Central Glass and Ceramic Research Institute

THERE are few fields of industrial development in which scientific investigation has played a more decisive role than in the glass and ceramic industries. Whereas spectacular developments in these industries backed by scientific investigations have taken place in hte countries of Europe and America, conditions in India have remained comparatively static. The need for the establishment of a central research institute for these subjects was felt ever since 1918 by the Indian Industrial Commission and was emphasized again by the Indian Tariff Board, 1931. It was more keenly felt during World War II. To meet this long felt want, the Council of Scientific and Industrial Research decided in 1944 to establish the Central Glass and Ceramic Research Institute as one of a chain of National Laboratories at Calcutta, a big centre for glass and ceramic industries and a great seat of scientific activity.

The Institute is located in Jadavpur in the southern suburbs of Calcutta. The foundation stone of the Institute was laid on December 24, 1945, by the late Sir Ardeshir Dalal, a past General President of the Indian Science Congress Association and then President of the C. S. I. R. and the Institute was formally declared open in August, 1950.

Scope of Work : Broadly speaking the functions of the Institute are:

(*i*) Fundamental research having a bearing on different branches of glass and ceramic,

(*ii*) Testing and standardization,

(*iii*) Technical assistance to industry,

(*iv*) Dissemination of technical information,

(*v*) Training of technologists for special work.

In addition to fundamental research, emphasis is laid on problems of direct bearing to the industries.

The Institute has an Advisory Board consisting of eminent scientists, industrialists and representatives of the industry, which advises with regard to its programme of research and reviews its progress.

Present Activities:—The investigations af present undertaken at the Institute can be classified under four heads, namely, fundamental research; investigations on the availability of raw materials, their beneficiation; standardization of raw materials and finished goods; improvement in the quality of finished products, finding out substitutes for raw materials in short supply including utilization of naturally occurring materials, investigation as to the possibility of producing articles in the country so far imported.

Under fundamental research, researches are in progress on the properties of clays and steatites available in India and on the origin of colour produced in glass by different colourants. Investigations on raw materials form part of a long range programme. The Institute has already published results of detailed investigations on the availability and beneficiation of raw materials required by the glass industry in the country. This work is being continued. Systematic work is now in progress in collaboration with the Geological Survey of India on the study of different clays required in the ceramic industry. Already about 800 clay samples have been examined. Standards for raw materials, such as sands, sandstones, quartzites, limestones, felspars, dolomites, steatites, clays etc. are being laid down keeping in view the quality of such materials in the country. A number of the specifications have been finalized. This work is being done under the Indian Standards Institution. In addition, beneficiation of raw materials, wherever they are of lower grade, is being actively pursued and special equipment such as a sand-washing plant of about half a ton capacity and a magnetic separator have been installed for such work. Specifications are also in the course of preparation for the finished goods such as glass ampoules, sheet glass, ink bottles, chemical porcelain, etc.

A special study is being made of the glass container like bottles, jars, etc. which are used in large numbers for a wide variety of purposes in the chemical and pharmaceutical industries so as to improve their quality. The work has specially been concentrated on producing suitable ink bottles in view of its great importance to the growing ink industry. Systematic study of refractory clays for their physical and chemical properties is in progress with a view to producing saggars with longer life so extensively employed in the pottery industry which will help in reducing the cost of production of pottery ware. Steatites of Indian origin are being studied with regard to their composition, petrographic and fired properties for the production of electrical porcelain and also for their utilization in the pottery industry in general.

Several raw materials required by these industries are scarce in the country, whose supplies may be cut off during emergency. Systematic study has been instituted for finding out substitutes for borax and selenium which are very essential for the ceramic industry. In addition, investigations are in progress on the utilization of naturally occurring saltcake at Didwana (Rajasthan) as partial substitute for soda ash for the glass industry, which is in short supply. Promising results have been reported. Materials like mica waste are being studied for their utilization. The utilization of lime sludge obtained in the manufacture of acetylene gas is being studied for making lime bonded sand bricks and has yielded promising results.

A special variety of glass of multicellular structure called foam glass possessing the lightness of cork and good heat insulating properties has been developed. It is expected to have great potential use in a tropical country like India in housing and refrigeration industry.

Investigations on the possibility of producing in the country articles such as signal glasses required by the railways, chemical porcelain, glass electrodes for *p*H meters extensively employed in scientific institutions and industries, enamelled ceramic resistors used in electrical industries, decorating materials, particularly ceramic colours, required in the glass and pottery industries, have yielded promising results. All these articles are at present imported. There are several small articles without which special instruments are almost rendered useless; their import is so small that an industrial concern may not be interested in their manufacture. In this connection, the Institute has specially organized facilities for such work and at present articles like pyrometer sheaths, small crucibles and special refractory parts have been produced at the Institute and the facilities of this section have been given to scientific and research institutions.

The Institute has a well-equipped library for glass and ceramic subjects and has a fairly large collection of back volumes of journals on these subjects. The facilities of the library are open to scientific workers from other institutions as also from the factories during working hours.

The Institute also maintains a Museum displaying a large collection of raw materials obtained from different sources, processed raw materials, and finished products from Indian as well as foreign glass and ceramic manufacturers. Some specimen of ancient glasses, terra cotta from Mohenjodaro, special samples from Egypt and samples of historic and scientific associations are also exhibited. Exhibits illustrating some of the recently developed novel applications of glass are also on view.

There is a variety of equipment assembled for glass and ceramic research but a special feature is the arrangement for handling bulk samples and a wide variety of experimental furnaces. Detailed testing of refractories has also been organized.

Department of Anthropology

THE Department of Anthropology, on its separation from the Zoological Survey of India, of which it was originally a part, started functioning as an independent Department from December 1945.

The Department shifted to the Indian Museum, Calcutta, in its new rooms in July 1948, but took more than a year before all the sections could be properly organized and collections both skeletal and ethnological arranged and got ready for work.

Besides the main Laboratory of Physical Anthropology, Laboratories of Anatomy, Comparative Morphology, Primitive Linguistics, Radiology and Statistics were set up, all equipped with the necessary instruments. The Laboratory of Experimental Psychology for Psychometric work has been greatly extended with the accession of a large number of modern psychological test materials. In addition, the nucleus of the Laboratory of Clinical Psychology with various kinds of projective tests has been formed. A well-integrated and comprehensive scheme of anthropological study must include the application of psychological methods and the study of the structure of personality of the different groups. Similarly the study of dietetics of the various tribes is essential before the life of the community as a whole can be assessed. With a view to carrying out this work a fully equipped Bio-Chemical Laboratory devoted to the study of food and nutrition has been started.

Among the instruments purchased during this year were Cine cameras equipped with telephoto lenses and projectors and Auricon wire recorders for recording music and phonetics of primitive tribes and a x-ray processing tank cabinet for processing of x-ray films.

Dr. Ernst Carl Buchi, of the Institute of Human Genetics, Copenhagen, and formerly Privat-Dozent of the Institut anthropologisches of the University of Zürich, was appointed by the Government of India as Superintending Anthropologist on the recommendation of the High Commissioner for India and joined his duties from the end of the year 1950.

The Budget Grant of the Department which was Rs. 5,14,300 in 1950-51 has been increased to Rs. 5,78,500 in 1951-52.

When the Department was first started it had only about 500 volumes—its share of books from the Z.S.I. During the last 5 years the total number of volumes has increased to 19,000 and instead of 3 journals, the Department now possesses more than 30. Back volumes of rare anthropological journals in European languages have been procured and many of these sets are now complete or nearly complete.

Scientific Researches : The most important scientific investigation carried out during the years was the survey of the Community Life in two centres in Southern Bengal, namely, the rural area of the Sarisa Union and an industrial centre in the Budge Budge area, in connection with the Unesco Project of Pilot

Studies on Community Life in India, Australia, Sweden and France. According to the scheme adopted in the Paris Conference in 1949, a detailed Bio-Socio-Economical Survey of the people was undertaken, besides examination of the health and dietary. In addition, for the first time in India, latest Projective Tests like Rorschach, Thematic Apperception and Horn-Hellsberg were applied and Social Distance Scale, Attitude Scales and Intelligence Tests like Wecshler-Bellevue were also given. It is expected that, when the data are finally analyzed, a great step forward will have been taken in modern scientific investigations of social and communal life in this country.

Next to the Unesco studies, researches of major importance were undertaken among the Abor tribes of the North-Eastern Frontiers of India and a party went to the Upper Yamne Valley to work among the Padam Pangi and Minyong sections of the Abor tribe. Full records of their music, phonetics and religious rites and dances were taken besides detailed information on their social structure, dietary, bio-physical constitution, etc. The region surveyed, now greatly affected by the earthquake, is very little known even to the administration. Prof. Georg Morgenstierne of Oslo and easily the most distinguished authority on Indian languages paid a short visit to the Lower Abor region to help in the training of the linguists of the Department in the field methods of linguistic researches. His service has been of inestimable value to the scientific work of the Department.

Another important anthropological survey was carried out by a second party among the little known hill tribes of Travancore and full anthropological materials, including Somatometric, Serological and Psychological, were collected on the Kanikkars, Uralis, Malapantarams and other primitive tribes of the Travancore hills.

Investigations on the surviving members of the aboriginal tribes of the Andaman Islands, namely, the Onges of the Little Andamans and the Jarawas of South Andamans have been taken up and visits were paid to the Islands for the last three years. It is proposed to establish a small sub-station of the Department at Port Blair to systematically study these tribes, which is expected to be of practical benefit to the Government in the administration of the primitive but very hostile inhabitants of these Islands.

Along with these major surveys, work was continued on the prehistoric and rich skeletal collections, both human and animal, of Mohenjodaro, Harappa, Ujjain and other ancient sites of India. At the request of the Mahabodhi Society, Calcutta, the sacred relics of Mogallana and Sariputta Arhans, Lord Buddha's disciples, were chemically treated by this Department to guard against any further decay. Researches on blood groups and their types particularly Rh, which is a genetic factor of blood groups, were carried out. For this purpose, blood samples of several persons were taken and investigated. Two cases of repeated abortions were referred to this Department by the Chittaranjan Medical College and Calcutta Medical College Hospitals and the reports in these cases were submitted to the hospitals.

Publications.—The Department proposes to publish three series: (1) bulletins containing shorter papers; (2) memoirs embodying the results of integrated studies on a particular tribe or subject by a single or several authors; and (3) small pamphlets in the different Indian languages containing accounts of researches in popular form which are of interest to the people in general or have practical bearing on the life of the people.

Research Laboratories under Industrial Organizations

LIKE other greater cities of the world, Calcutta is situated on the bank of a river near the sea. Port facilities, proximity to the coal fields, large consuming markets and cultural importance of the city have been responsible for the development of different industries in and around Calcutta. The province of Bengal grows a very important economic crop in jute and this has helped in the establishment of a number of mills on both the banks of the Ganges in neighbouring districts of Calcutta, Howrah, Hooghly and 24-Parganas. Subsequently, many other industries have been developed in Calcutta and its suburbs, and due to this position even the partition of the province has not affected in any large measure the industrial importance of the city. Table I showing the output of different commodities from the industries located in and around Calcutta will convey an idea of the industrial activities of this zone of the Indian Union.

TABLE I

INDUSTRY	PRODUCTION PER ANNUM	
	In value (rupees)	*In weight or number*
Belting		6,300 tons
Biscuits		350 tons
Cloth		448 million lbs. of yarn and 165 million yds. of cloth
Dry cells		100 million batteries
Electric fans	1.6 crores	1 lakh
Expanded metal ...		4,000 tons capacity
Enamels	48.3 lakhs	1,300 tons
Fertilizers—		
Superphosphate ...		15,000 tons
Potash nitrate ...		3,000 tons
Compound ...		20,000 tons
Glass (all types) ...		25,049 tons
Jute	127 crores	
Lamps (electric) ...		6.8 million
Liquid chlorine ...		1,500 tons

TABLE I

INDUSTRY	PRODUCTION PER ANNUM	
	In value (rupees)	*In weight or number*
Match		47 lakhs gross
Motors (electric) ...		15,000 H.P.
Machine tools ...		over 1600 Nos.
Paint and Varnishes ...	4 crores	35,000 tons
Plywood		10 million sq. ft.
Potteries		9,000 tons
Ropes	200 lakhs	
Rubber goods ...	8.9 crores	
Silk	90 lakhs	30 lakh yds.
Sulphuric acid ...		8,000 tons
Vanaspati		20,000 tons

All these developments are largely based on the inter-action of science and industry. Science reveals the truth and facts, and the industry applies them for utilitarian ends. In this way, the industry has been affording a tremendous impetus to pure science. But the function of a laboratory in any industry fundamentally differs from that of a laboratory in the university. In order to promote industrial activity, the applications of fundamental science are, however, to be stimulated, and the faculty of applying science for the needs of man is to be cultivated. A fine film of a metallic wire becomes incandescent when hot, and this gradually undergoes deterioration by oxidation when burnt in presence of oxygen. Both the phenomena were known but it required an Edison to correlate the two fundamental properties of a wire to have a lamp for lighting purpose. Similarly, a search for knowledge as was done by Pasteur in his work with grape vines gave rise to the industries that now deal with microbiological problems. Once an idea is gathered, it might give a stimulus towards the formation of an industry; but for its further expansion more basic knowledge is to be accumulated from the laboratories devoted to fundamental work. As a matter of fact, the function of most of the laboratories of the local industries lies in the service they give to the factory. This enables the firm to provide useful goods of uniformly high quality at reasonable prices to the community. Further research is also pursued in an attempt to utilize as well as to encourage production from indigenous raw materials. The industries have to work with scientific personnel trained in their own laboratories, as often such training facilities are not available either in the state or university laboratories for the applied science in which the local industries are interested. To fill up this gap in our technical training newer courses are being introduced and newer laboratories started within the locality. In this connection reference should be made to glass, ceramics, plastics, pharmaceutics, electronics, soaps, tanneries and many others.

During the process of manufacture of articles as shown in Table I, most of the factory laboratories are to perform at least three-fold functions in assisting (*i*) process control, (*ii*) quality control, and (*iii*) developmental work. For these the various laboratories are to remain responsible for carrying out swiftly and correctly all analytical work required for contolling the quality of the products through different stages of production. Numerous chemical, physical, bio-chemical and biological tests are carried out on all raw materials, chemicals and appliances to ensure that these are strictly upto specification and requirement. Often work is to be carried out for improving the manufacturing process, method or technique. This needs a co-ordination of work by different groups of scientists and engineers and each group will have to apply other's knowledge with precision. In certain factories again, laboratory workers are required to handle problems which bear no direct relation to the specific branch of science in which they have specialized during their professional training. Such investigations need knowledge on basic, social and applied sciences. These relate to marketing research and involve studies on social and cultural problems, climatic influences, nature of packing materials, effect of humidity, temperature and air, and many other inter-allied problems. Some of the industrial laboratories are well-equipped and are in a position to take up complex nature of work in their own lines. For this they have to maintain an up-to-date library consisting of standard books of reference, periodicals and journals. As the work is of an objective nature and is in direct relation to their specific problems, publication is seldom found in the regular scientific journals; some of the investigations are recorded as patents. With the development of work in applied sciences in some academical institutions, the literary activities of the industrial laboratories are expected to expand. In Table II the names of certain industrial laboratories of different categories, their local addresses and their lines of activity are enlisted for general information.

TABLE II

LABORATORY	LOCATION	INTERESTED IN:
Angelo Brothers Ltd.	7, Ram Gopal Ghose Lane, Cossipore, Calcutta	Shellac and shellac wax
Aluminium Corporation of India Ltd.	Jay Kay Nagar, Dist. Burdwan	Bauxites, Titanium, Aluminium, Electrodes and Aluminium alloys
Burmah Shell	Shibpur, Howrah	Lubricating oils and Petroleum products
Indian Jute Mills Association	Alipore	Jute and Jute products
Khaitan Sons & Co.	P.O. Rishra, Hooghly	Fertilizers and manures
Lever Bros. (India) Ltd.	63, Garden Reach, Calcutta 24.	Toilets, soaps and glycerine
Phillips Electrical Co. (India) Ltd.	Heysham Road, Calcutta	Radio sets
Tobacco Manufacturers (India) Ltd.	Circular Garden Reach Road, Kidderpore, Calcutta.	Tobacco and Cigarettes

Nearly every industrial organization has today added a section which is called "Research Laboratory" or the "Research Department". This section has probably been created to invent new products, to find new uses of old products, and to utilize indigenous raw materials for process work. But, in practice, this department is also a "staff department"; that is, it is a service department to promote production and sales. Some of the organizations, however, felt that the research section must work for the overall developmental activities and it must have the following objectives: basic research, process research and application research. As has already been mentioned, jute industry is the most important large scale industry in the State of West Bengal. There are 72 working mills and they consume annually about 10,46,000 tons of raw jute. For many years the Indian Jute Mills Association had been endeavouring to start a research institute of their own to improve the manufacture of jute and its processing and for further commercial development. The scheme is matured and there is now a full-fledged research institute "Ijmari".

Bengal Immunity Research Institute

The Institute was founded practically in the year 1935 as a "brain child" of (late) Capt. N. N. Dutta, the then Managing Director of the Bengal Immunity Co., Ltd., in his desire to facilitate the expansion of the Company. But when the laboratory became popular in the organization, he decided, and correctly so, to shift the laboratory from the factory side to the heart of the city. The Institute is now functioning at 39, Lower Circular Road, Calcutta and is devoted to carrying out researches on medicinal, pharmaceutical and biological problems. It is a commodious building and has a small auditorium, a good library and a crude drug museum.

The Institute pursues scientific research for utilitarian ends and in doing so provides facilities for exploratory research, technological work, improvement research and market application research. Investigations carried out at the Institute have led to the better understanding of the cause of deterioration of enzymes and vitamins and of the mode of action of some physiological principles. Synthetical work on antimalarials, sulpha group of drugs, organo-metallic compounds and some other products have revealed a new approach towards the discovery of remedies for the treatment of diseases caused by some pathogenic organisms. Work on glands and glandular products has helped in better standardization of many organo-therapeutic products. Researches with toxins and anti-toxins have resulted in finding out methods of assay of the complex biological medicaments.

The advance of knowledge has been rendered possible for the maintenance of a laboratory with various sensitive and precision apparatus. A large animal colony helps in satisfying the needs of different investigators on biological problems and the library accommodating more than 6,000 volumes of technical journals and subscribing more than 100 journals, meets the demands for having a complete picture of the work that is being followed elsewhere in India, or, abroad in pharmaceutical and biological drugs. A complete account of the investigations carried out at the Bengal Immunity Research Institute will be found in the various issues of *Immunity Bulletin*, an annual publication from the Institute.

Sir P. C. Ray Research Laboratory

The Laboratory is organized by Messrs. Bengal Chemical and Pharmaceutical Works after the name of the Founder of the Company, the late Acharya Prafulla Chandra Ray. Researches of fundamental nature as well as of the applied type in chemistry, bio-chemistry, colloids, and chemotherapeutics have been carried on in the different sections. Special mention may be made of the isolation of riboflavin from ox-kidney, development work for the large scale production of ephedrine, strychnine santonine and emetine, and of the technological work for the conversion of gallic acid into pyrogallol. The laboratory also works for applied research, which has enabled large scale production of many fine chemicals and pharmaceuticals on economic basis. Workers are also interested in plant products and the recent elucidation of the chemical constitution of andrographolid, the active principle of "Kalmegh"—*Andrographis paniculata* Nees, is a distinct contribution of co-operative research.

The library of the laboratory contains about 7,000 volumes on different scientific subjects. The number of current journals and periodicals is also about 100. The complete sets of Ullman's *Enzyklopadie der technischen Chemie*, Merck's *Jaresbericht*, Hoppe Seyler's *Zeitschrift für physiologische Chemie*, and a number of other standard German books, are the notable collections of the Library. More than 200 papers have been published in different scientific journals, and as also some monographs in regional language.

Research Department and Laboratories of Messrs. Bird & Co.

The Department and Laboratories were founded about 1917 and are situated now in Chartered Bank Buildings, Dalhousie Square, Calcutta. The main function is to advise on general technical questions, process development and control and to carry out analysis and testing of various types. This covers all kinds of geological work (prospecting, drilling, ore concentration, etc.), paper, plywood, refractories, metallurgical, coke and byproducts, chemical, jute, oil and other industries.

The laboratory has an up-to-date library and the members of the Department have contributed papers of a technical and fundamental nature to scientific journals. A number of patents have been taken out by the Department. It extends its facilities to persons or concerns interested in technical advice.

Radon House Research Laboratory

This Laboratory is interested in x-ray plants for scientific research, industrial testing and medical diagnostic work; varieties of electro-medical apparatus; electrical measuring instruments and H. T. transformers. The Laboratory is now particularly engaged in developing a new (Pauthenier) type million volt generator suitable for x-ray therapy and nuclear research, in the design of extra high power x-ray diagnostic plants and very low voltage x-ray (ultra Grenz-Ray) therapy apparatus, and also in electrical characteristics of different x-ray circuits.

Laboratory of Express Dairy Company

The Laboratory is engaged in many investigations dealing with cattle breeding, sterility, lactation and interallied dairy problems. Reducing the dry period in an animal to a lowest possible period, getting heifers to breed their first calves within three years of age and rendering such animals that do not successfully breed or are barren or sterile into milch stock straight away, are some of the problems that have been successfully carried out. The Organization has a free technical service made available for the cattle owning public.

Besides the above laboratories under industrial organizations, there are some in and around Calcutta where certain original investigations are also being carried out from time to time and the findings are published in one or other scientific journal. Mention may be made of the Ichhapur Gun and Shell Factory, Standard Pharmaceutical Works and some others.

SECTION V

RIVER VALLEY PROJECTS

River Valley Projects in West Bengal

THE concept of the multi-purpose development of river valleys has now taken root in this country. For centuries past the treatment of rivers has been looked at in one or another aspect but rarely in integrated aspects. Thus, when a river was found to overflow its banks during the rains, embankments were built for affording protection from flood. Rivers have been bridged to facilitate communication. Water from rivers has been canalized to provide irrigation. But hardly have the waters of a river been treated in a unified manner so as to promote a multi-facet co-ordinated development of the entire valley through which it flows. In recent years, however, particularly since the successful experiment of the Tennessee Valley Authority in America, there has been a widespread recognition throughout the World that it is far more rational and economic to handle a river in all the aspects in relation to the resources and the needs of the river valley concerned. In the Tennessee Valley, for instance, dams have been built which perform the triple functions of controlling flood, generating electricity and facilitating navigation. The power development has led to a phenomenal progress of industries in the valley utilizing its natural resources. The aluminium industry, developed as the direct result of the Tennessee Valley project, helped the U.S.A. materially during the last war. Phosphatic fertilizer industries have been established in the valley, which have had their effect on the productivity of the soil in the entire area. The food produced has been protected from spoilage by the development of refrigeration. In fact, laboratories established by the TVA have themselves developed and patented refrigeration devices for the preservation of food. In order to retard the silting up of reservoirs extensive afforestation has been resorted to in the valley, which, while giving long life to the reservoirs, controls soil erosion, produces timber and helps the navigation of the Tennessee River. At the same time, as malaria is often associated with the impounding of water, the TVA has an extensive programme of malaria control in the valley. Thus the results of the efforts of the TVA in promoting the co-ordinated development of the Tennessee Valley in relation to its industries, agriculture and health are manifest.

Damodar Valley Project

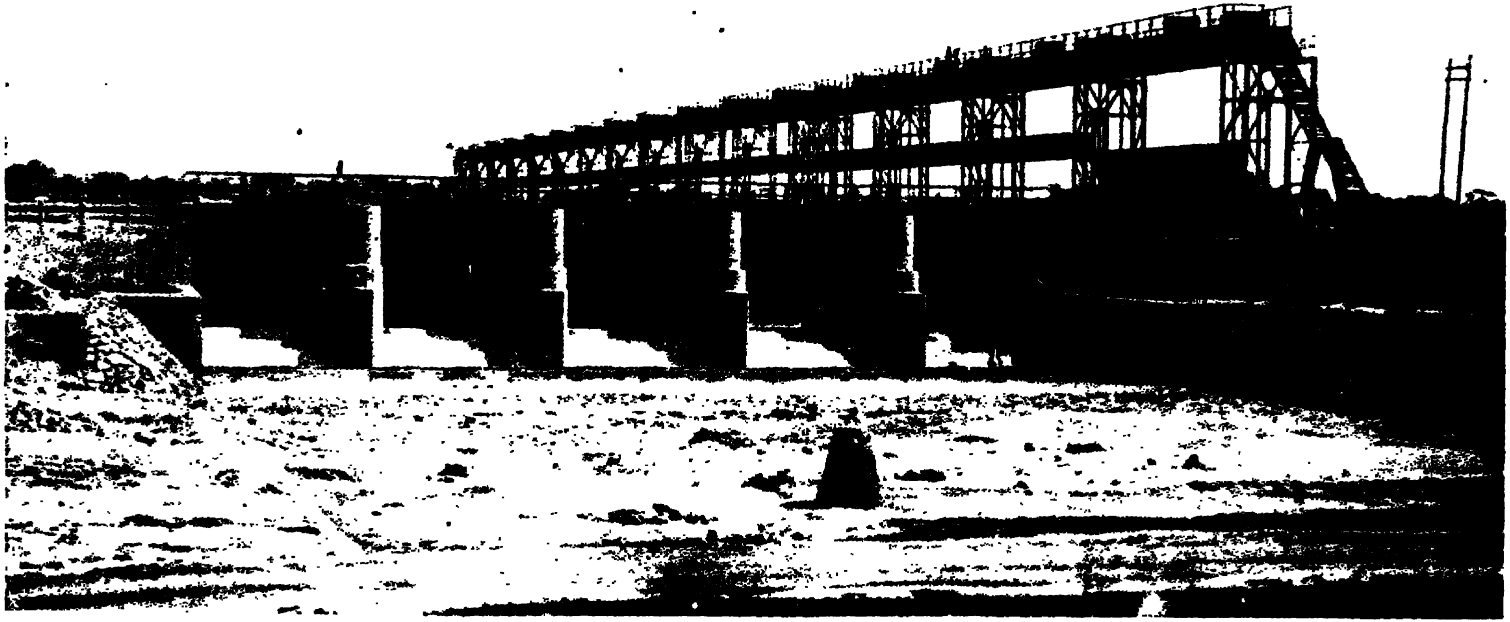
The Damodar Valley Project is a similar multi-purpose project treating the Damodar Valley as a whole. The Damodar is a notoriously destructive river which originates in the uplands of Bihar, flows through West Bengal and joins the river Hooghly below Calcutta. Due to deforestation in the upper valley and steady soil erosion, more and more silt and sand have been coming and depositing in the lower reaches of the Damodar raising its bed-level. This is aggravated by silt bars brought by the tides from the Bay of Bengal. The river, therefore, tends to have less and less capacity for carrying flood water which naturally overflows its banks. A flood in 1943 had actually torn off the embankments of the left bank of the Damodar and washed away parts of the arterial railway and Grand Trunk Road from Calcutta to north-western India. When it was found that embankments failed to resist flood the Damodar Flood Enquiry Commission was set up which recommended the adoption of a scheme involving the construction of some dams. The scheme, as at present under execution, was developed chiefly by Mr. Voorduin, a TVA expert, who was a member of the Central Technical Power Board of the Government of India.

The Damodar river runs through the States of Bihar and West Bengal and its drainage area covers 8,500 square miles. The project consists essentially of constructing:

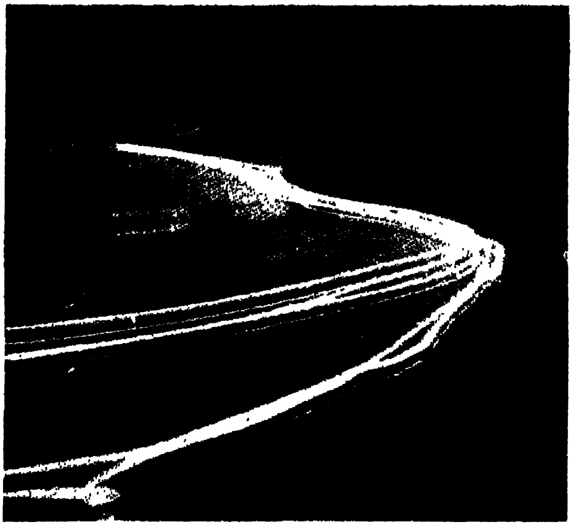
(*i*) Eight dams on the Damodar and its tributaries with hydro-electric stations and two auxiliary plants with a total installed capacity of 240,000 kw.; the total controlled reservoir capacity would be 4.7 million acre-feet and protect the valley from floods up to 1 million cusecs;

(*ii*) A thermal power station, utilizing low grade coal of 200,000 kw, installed capacity to even out the seasonal fluctuations of hydro-electric power and to provide, in combination with the hydro-electric system, firm power of 300,000 kw. capacity at 60% load factor;

(*iii*) A power transmission grid covering 475 miles of 132 kv. primary line with necessary lengths of 66 kv. secondary lines; and



CONCRETING ON DAM WITH DRAGLINE AT KONAR, D.V.C.



MODEL OF THE RIVER BHAGIRATHI AT KALNA

The white lines of flow show the streamlines during the moderately heavy flood. The photograph shows how the main current of the river was striking against the bank on which the city of Kalna is situated (*iv*) A barrage and a 90-mile long irrigation *cum* navigation canal with a system of distributaries measuring 1,553 miles in length and irrigating over 1 million acres of fertile alluvial soil.

The plan is to suitably store the rain water during the monsoon in the reservoirs formed by the dams so as to prevent floods in the lower valley and at the same time to gradually release the water from the reservoirs producing hydro-electric power, irrigating a million acres of land and facilitating navigation from Durgapur, which is below Asansol, to Calcutta *via* the canal and the river Hooghly. The main object is the multi-purpose development of the Damodar Valley. Thus, along with this construction project steps are being taken to control soil erosion particularly in the upper valley by the usual practices of soil conservation, *viz.*, terracing, contour ploughing, damming up of rivulets, planting suitable grasses, gully-plugging, afforestation, etc. With regard to the utilization of power in the valley which is rich in coal and several mineral resources, investigation has been undertaken by the Geological Survey of India in the valley and its surrounding area to locate useful minerals which could utilize the power and water that would be made perennially available as a result of the project for the development of suitable industries. Similarly, along with the initiation of soil conservation practices and the provision of water for irrigation, attempts are being made to improve agricultural techniques through experimental and demonstration farms and make optimum use of the water available for the production of food and other crops. It is estimated that as a result of the project about 200,000 tons more of rice will be available and also large quantities of winter crops which together would be worth about 25 crores of rupees annually.

There is also a great scope for development of industries for the production of insulators, fire-bricks, aluminium, calcium carbide, etc., utilizing the mineral resources of the valley. The development of fisheries in the impounded waters and irrigation channels is envisaged. The lakes formed will also provide facilities for recreation. Malaria control is an important feature of the project because large parts of the valley are malarious and there may be tendency for malaria incidence to increase in certain parts as a result of the dam and irrigation project. The displacement of people from areas to be innundated raises the problem of rehabilitation which also offers opportunities for the intiation of co-operative or collective farming at a higher technical level and also the introduction of cottage and medium-scale industries utilizing power which would be made available fairly cheaply as a result of the project. All these co-ordinated developments based on this multi-purpose river project are calculated to raise the economic level of the people of the valley and its neighbouring areas to a significant degree in five years' time and strengthen the national economy of India as a whole.

The project has been split into two phases. The first phase which is due to be completed by 1955-56 comprises the construction of (*a*) four dams at Tilaiya, Konar, Maithon and Panchet Hill, (*b*) the barrage and irrigation system, (*c*) the thermal power station at Bokaro and (*d*) the transmission system. Construction of the Tilaiya dam is expected to be finished by the middle of 1952 and the impounded water will be available for irrigation from then on. The Konar dam is designed particularly to supply cooling water to the Bokaro Power Station. It will be ready to supply sufficient water to run the first unit of 50,000 kw. at Bokaro by the autumn of 1952 and will be completed by June 1953. The Konar water will also be available for irrigation after cooling the power station. Bokaro will begin to function with one unit by August 1952 and will have three units of 50,000 kw., each running by the spring of 1953. The transmission system is being built to connect Bokaro with Calcutta *via* Jamshedpur, Ghatsila and Kharagpur and also *via* Asansol, Ranigunj and Burdwan. Hydro-electric power as well as the excess of thermal power available from Sindri Fertilizer Factory are being fed into the grid. Many coal mines and industrial firms are already contracting to obtain power from the DVC system. Power has already been supplied to Kodarma Mica Mines, Hazaribagh town and the Chittaranjan Locomotive Works from oil-burning sets.

Agricultural experiments carried out in Burdwan district have shown that, in addition to the *aman* or *aus* paddy crop, a *boro* (winter) paddy crop would be easily obtained, as soon as water is available. Double cropping and even triple cropping should be possible in large areas, under conditions of scientific farming, including the supply of necessary fertilizers, crop rotation, green manuring, etc.

By the Damodar Valley Act, Parliament has entrusted the execution of this project to a Corporation, constituted more or less on the lines of the TVA and having somewhat similar terms of reference. The project is being financed by the West Bengal, Bihar and Central Governments roughly in the ratio of 57:18:25 per cent. The first phase is estimated to cost Rs. 76 crores. Apart from producing additional food worth about Rs. 25 crores at current prices, the project will supply 940 million kwh. per year at 55% load factor bringing a net revenue of 2.5 crores of rupees. The industrial development possible by the use of such a large amount of power with all the resources available in the valley and its operational area is naturally of a very large magnitude. The investment in the project is, therefore, small in relation to the enormous agricultural and industrial potentialities of the project.

Mayurakshi Reservoir Project

The principal feature of the Mayurakshi Project is the construction of a reservoir by building a dam, 2,170 feet long and 113 feet high, across the Mayurakshi at Massanjor in Bihar, where the river passes through a narrow gorge. The reservoir, which has a catchment area of 718 square miles, will cover 27 square miles and will store 5,00,000 acre feet of water, measuring 13,620 million gallons. It will spread to a distance of 15 miles along the river and reach within two miles of Dumka, the headquarter station of the Santal Parganas. This dam is now under construction.

The Tilpara Barrage and Headworks, near Suri in Birbhum district of West Bengal, the construction of which has just been completed, is situated 22 miles down the dam. The barrage is 1,013 feet long, with fifteen gates, each 60 feet wide. The barrage will head-up the water to a height of 20 feet and create a pool along the river-bed, which will be nearly 5 miles in length. Each of the main canals, which take off the river near the barrage, will have a capacity of 3,500 cusecs of water, equivalent to nearly 13,00,000 gallons per minute.

The main canals will be taken over a number of cross-drainage works, the most important of which are the barrages across the Bakreswar and Kopai on the south bank and the Dwarka and Brahmani on the north, varying in length from 200 to 450 feet. The total length of the canal system, including distributaries, will be about 840 miles. Nearly 1,500 canal structures, including falls, regulators, aqueducts, siphons and bridges will be built over the area of 1,340 square miles, which will be served by the canals.

Irrigation is the main purpose of the Project, though flood-control and generation of hydro-electric power will also be its subsidiary benefits. The area that will be commanded by the canals is already very heavily cultivated, the proportion of the cropped area being nearly 90 per cent. The cultivation is almost exclusively confined to *aman* paddy. Doubts have been expressed as to the necessity of giving *kharif* irrigaton to lands which are already growing paddy; and, it has been suggested that the available water should have been utilized for rabi irrigation. This subject had been very carefully examined before the plans were finalized. Most of the 'commanded area' is undulating, and a good rice crop is grown only at the bottom of the valleys. The rest of the fields do not retain sufficient water. Moreover, the distribution of rainfall in this region is often unsatisfactory, and long periods of drought intervene. As a result, the average yield is low, being approximately 16 mds. per acre. Even this outturn is not always certain and partial failures of crops are not too infrequent. *Kharif* irrigation will not only act as an insurance, but it will also lead to a substantial increase in the yield from the area. It has been estimated that on an average the extra outturn of paddy will be half-a-ton per acre.

Perennial irrigation will be given to 1,20,000 acres. Most of the soil is capable of growing such valuable crops as potato, jute, sugarcane, mustard and wheat. A careful programme of rotation of crops is being drawn up for intensive double-cropping of the area which will be given irrigation throughout the year.

Apart from other benefits, the Mayurakshi Project will increase the State's food production by 3,60,000 tons per year. The commanded area, which is now one of the poorest in the State, will become highly prosperous.

The cost of the Project, which is estimated to be Rs. 15.5 crores, is by no means high, when measured in terms of its benefits. The country will get back the full value of the investment in less than three years' time.

River Research Institute, West Bengal

River Problems of Bengal

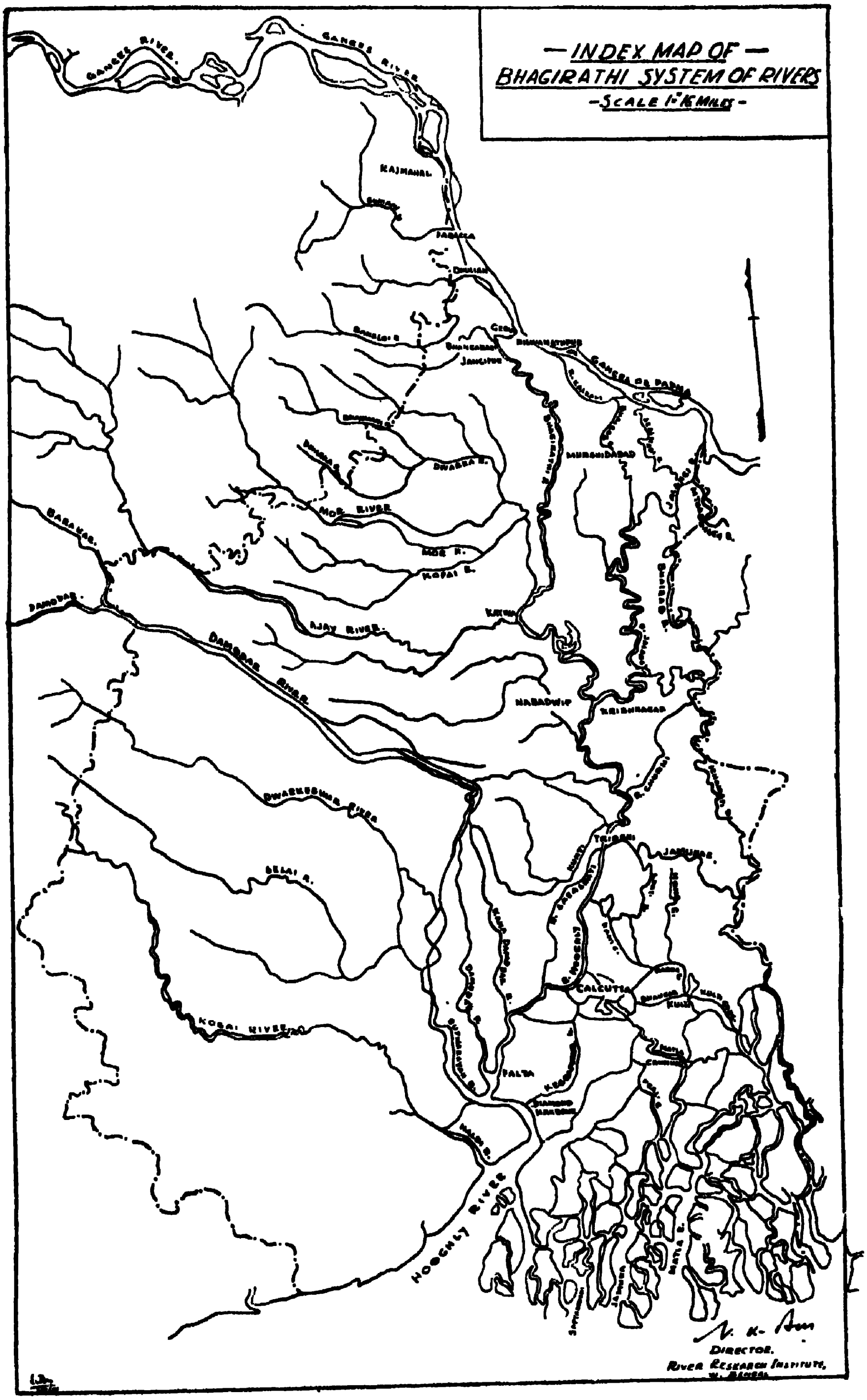
THE wealth of the State of West Bengal was at one time the envy of others and the theme of our poets. The source of that wealth lay in the abundance of our natural resources, and the most fundamental of them was our system of flowing river. The story of our economic decline is, in a vital sense, the history of the decay of our rivers.

After the partition of Bengal, the Bhagirathi occupies the most important place among the rivers that have fallen in the new State. From the map it will be seen that the Bhagirathi runs like the backbone through West Bengal. Coming out of the Ganga near about Dhulian, it receives water supply from both its banks situated in West Bengal. All the rivers of Santal Parganas and Chotanagpur bring down the rain waters of this area into the Bhagirathi. One characteristic of these rivers is that they swell up at the onset of the rains and pour into the Hooghly and Bhagirathi, flooding the villages and towns through which they flow. Floods in the rainy season and drought after that have been the annual experience of the inhabitants of this area.

Damodar Valley Corporation has been set up by the Government of India. It is proposed to put up 8 dams in the different parts of the river Damodar and its tributaries. These will not only prevent floods but will also generate hydro-electricity which will transform, like the Aladdin's lamp, the face of the whole of the area of West Bengal, Chotanagpur and Santal Parganas. Plenty of water will be available for irrigation and vast tracts of waste and fallow lands will be brought under the plough.

The map will show that the Bhagirathi comes out of the Ganga, and there are two other spill channels, the Jalangi and the Mathabhanga, coming out of the same river and meeting the Bhagirathi. The estuary of the Bhagirathi and the Jalangi is known as the Hooghly on which is situated the metropolitan town of Calcutta. The prosperity, health and happiness of Calcutta depend principally on the Hooghly estuary alone. The rivers from the west and east banks of the Bhagirathi that bring in volumes of water during the rainy season also carry down huge quantities of sand and silt. These sand and silt as they are brought into the estuary of the Hooghly are met by the tidal onrush that comes into the estuary from the sea face twice every day. The flow of water and sand brought down by these tributary rivers are retarded as soon as they are met by the tides and in consequence the sands are dropped on the bed of the estuary. The force of ebb and flow tides play with these deposits of silt and sand pushing them upwards and taking them downwards twice every day all throughout the season. There is no way out for these sands till these can reach the sea face and, in consequence, the estuary bed rises.

At the end of the flood season, the flow from Chotanagpur and Santal Parganas and also from the Bhagirathi, the Jalangi and the Mathabhanga diminishes and ultimately ceases. The Hooghly estuary, therefore, does not receive


— INDEX MAP OF —
BHAGIRATHI SYSTEM OF RIVERS
-SCALE 1" = 16 MILES-
GANGES RIVER
GANGES RIVER
RAJMAHAL
FARAKKA
DHULIAN
GERIA
BHAGWANGOLA
JANGIPUR
BANSLOI R.
BRAHMANI R.
DWARKA R.
MOR RIVER
MOR R.
KOPAI R.
BARAKAR
DAMODAR
AJAY RIVER
KATWA
MURSHIDABAD
GANGES OR PADMA
BHAGIRATHI R.
JALANGI R.
NABADWIP
KRISHNAGAR
DAMODAR RIVER
DWARKESWAR RIVER
SELAI R.
KOSAI RIVER
TRIBENI
JAMUNA R.
R. HOOGHLY
CALCUTTA
FALTA
DIAMOND HARBOUR
HALDI R.
HOOGHLY RIVER
MATLA R.
DIRECTOR.
RIVER RESEARCH INSTITUTE,
W. BENGAL

any water supply except for two or three months of the flood season and during other months of the year there is no flow in the estuary excepting that due to tides and there is no other way of excluding silt and sand from the bed of the estuary except by dredging.

The Commissioners for the Port of Calcutta, to keep the Hooghly navigable for their ships, have to do continuous dredging of the river bed from Calcutta downwards. Expenses involved in this are heavy, and the results doubtful. They have, therefore, proposed to excavate a broad canal (ship canal) from Diamond Harbour to Kidderpur Docks at Calcutta. These proposals are now being tested critically by the authorities. By this process they may keep a maritime traffic open, but it will not solve the problems of the Hooghly and the Bhagirathi.

On the east and south of Calcutta in the district of 24-Parganas the force of tide is very strong. Here the problem of drainage is most acute. In 24-Parganas and Midnapore, rain waters accumulate in low lying areas and find no passage into the rivers. The embankments that are put up on both banks of the rivers to stop the inflow of saline tidal water into the fields also stand in the way of the rain water being drained into the rivers. Waters remain standing for months during and after the rains and agriculture becomes impossible. The health of the countryside also deteriorates. The drainage is one of the biggest problems of 24-Parganas and Midnapore.

River Research Institute

These, in broad outline, are the problems of the rivers of West Bengal. To study and solve these problems on the same line as is carried out in the West, the idea of establishing a River Physics Laboratory in Bengal was first expressed by Prof. M. N. Saha in the Sir P. C. Ray Memorial Volume published by the Indian Chemical Society in 1932 and by Sri S. C. Majumdar in his lecture on River Problems in Bengal at the symposium of the National Institute of Sciences of India in 1938. They had strongly advocated the establishment of the River Physics Laboratory for Bengal and its present most appropriate name River Research Institute was given by them.

The River Research Institute was set up in 1943 and has expanded into the following laboratories:

(1) River Model Laboratory at Galsi Field Station;
(2) Tidal Model Laboratory at Belghoria Field Station;
(3) Statistical and Hydrological Laboratory with Headquarters at the Anderson House, Alipore; and
(4) Soils Laboratories at Russa.

It has been proposed to centralize all these activities at one place and a central laboratory building is being set up at Haringhata. As a first step in the development of the River Research Institute, the Soils Laboratory at Russa will be shifted to Haringhata as soon as the central building is ready. For this purpose an area of 350 acres of land has been acquired at Haringhata near the central laboratory building. Staff quarters have been put up and it is expected that a full-fledged colony of research workers will very soon grow up round the central building.

The Institute had been doing useful work during the last few years of its existence. A photograph of one of the model experiments carried out in the Institute to solve the river problem of West Bengal is given here.

The Institute has been intimately associated with the investigations for the Mayurakshi Project, the Damodar Valley Project, the Ganga Barrage Project. Besides the work for the West Bengal Government, the Institute has also carried out investigations for railway authorities and other private institutions.

SECTION VI

LEARNED SOCIETIES

Learned Societies

IF the educational and scientific institutions, government and industrial research establishments described in the foregoing sections bear testimony to the greatness of Calcutta as an unrivalled centre for education, learning and research, her numerous scientific societies, associations and learned bodies also unmistakably prove the high esteem in which learning is held in this city. Ever since the establishment of the Asiatic Society, the educationists, scientists, medical men, engineers and men of other learned professions have formed themselves into various societies and associations, all with the common objective of the promotion, advancement and dissemination of knowledge represented by the respective disciplines. With the passage of years, many such societies have ceased to exist but many more have appeared, and those which have come to stay to this day already make a formidable list. It is not our intention to trace the history of them all, nor do we propose to refer to all the existing learned bodies. In the following pages, we shall give a brief account of some of the important societies, arranged in order of the year of their establishment and divided into three broad categories, *e.g.*, (A) Scientific, (B) Cultural and (C) Miscellaneous. Needless to say that greater emphasis has been given on scientific societies and an attempt has been made to cover all scientific disciplines as far as possible.

A. Scientific

Royal Agri-Horticultural Society of India

The Society (1, Alipore Road) was founded in 1820 by Rev. Dr. William Carey who felt that an association should be formed with definite aims and programme for the improvement of cereals and vegetables of the country. An Agricultural Society of India was formally inaugurated at a meeting called on September 17, 1820 in the Town Hall, Calcutta, which was attended by 7 persons. The Society started with 35 members on its rolls. William Carey and Ram Kamal Sen were elected first secretaries. In 1826 its name was changed to the Agricultural and Horticultural Society of India and in 1935 Royal Agri-horticultural Society of India. From 1836-1872 the Society's garden was situated at Sibpur, and then it was transferred to its present site in Alipore. During the whole of the 19th century, the Society mainly devoted to import better seeds of vegetables, fruits and field crops and these were acclimatized at the Society's experimental farm (500 bighas) at Akra, near Calcutta and seeds distributed through the several branch Societies spread throughout the length and breadth of the country. The Society thus did pioneer work for the improvement of India's Agriculture.

With the growing needs of the country the Society was relieved of its agricultural work in 1900, and the Government grant was stopped. Since then the Society is self-supporting with a membership of over 1000 and is principally interested in horticulture (flowers, fruits and vegetables) and better lay out of gardens. The Society is affiliated to The Royal Horticultural Society, The Royal Agricultural Society and The National Rose Society.

In the past, the Society published *Transactions* and *Journals* and maintained a museum. A Bengali translation of the *Transactions* was also published. These publications have now ceased and is replaced by a Monthly News Sheet and Annual Report. There is a good library. The garden at Alipore is open to the public except on Sunday afternoons, when it is reserved for members. The Society has a Free Enquiry Bureau which caters to the public. The present President is Maharajadhiraj Bahadur Uday Chand Mahtab of Burdwan.

Calcutta Medical Club

The Club (91-B, Chittaranjan Avenue) is the oldest medical association of India, being founded in 1901 by the late Sir Nilratan Sircar and other prominent medical men of the time. The objects of the Club are the promotion of medical and allied sciences, the improvement of public health and medical education of the country and social contact among members of medical profession. It has a library containing 5,000 medical books and subscribes 200 medical journals both foreign and Indian. It holds clinical meetings, demonstrates medical films and helps medical practitioners for higher studies. It gives two awards every year of the value of Rs. 250/- each for (*i*) Sir Nilratan Sircar Memorial Oration, and (*ii*) Capt. Narendra Nath Dutt Memorial Lecture. The Club has its own monthly organ, *Calcutta Medical Journal*. The Hon'ble Dr. B. C. Roy is the present President.

Mining, Geological and Metallurgical Institute of India

The Mining and Geological Institute (27, Chowringhee) owes its origin in 1906 to the initiative of Mr. W. H. Pickering, the then Chief Inspector Mines and Sir Thomas Holland, the then Director, Geological Survey of India. They felt the need of a non-official voluntary organization through the channels of which technical and scientific men and employers could freely discuss, and to their mutual advantage, the problems which continually arise in the mining industry. The word 'Metallurgical was included in the title in 1937. The Institute started with 153 members and has now on its rolls 750 members. It has three branches at Dhanbad, Jamshedpur and Asansol.

The aims and objects of the Institute include the promotion and encouragement of the study and practice of all branches of geology, mining and metallurgy in India and dissemination of scientific and technical information pertaining to these sciences. Its publications include:

(1) *Transactions* (now in its 47th volume), published 2-4 times a year;
(2) Notes & News (five numbers issued so far, since 1948);
(3) Indian Mining (second edition under preparation); and
(4) Directory of Indian Mines and Metals (now in press);

The Institute receives more than 150 journals from India and abroad in exchange of its publications.

The Institute awards annually a gold medal and Government of India prize of Rs. 500/- (in cash), a silver medal and a bronze medal to the authors of three best papers published in the *Transactions* provided the papers attain a high standard. The Institution has been called upon to advise Government from time to time on important committees and conferences *e.g.*, Coal Dust Committee (1922), Subsidence Committee (1939), Indian Coal Committee (1937), Indian Coalfields Committee (1946), National Mineral Policy Conference (1947), Draft Mining Rules etc. The Institute has set up a strong committee which is considering the question of providing a building of its own offices and of other sister institutions in the city, library, and residential quarters for visiting scientists on the lines of the Burlington House, London. The present President is Dr. D. N. Wadia.

All-India Medical Licentiates' Association (Bengal Provincial Branch)

Improvement of the service conditions of the staff employed in the railways, tea gardens, mines and other corporate bodies and belonging to the subordinate service was the main object that led to the establishment in 1906 of the Hospital Assistants Association to which the Agra Club (founded in 1904) and Madras Association (founded in 1905) were subsequently amalgamated. In 1910, the name of the organization was changed to All-India Sub-assistants Surgeons' Association and the present name was adopted in 1924 when independent practitioners joined the Association in large numbers. The Bengal Branch (27, Dixon Lane) was started in 1924, which holds a provincial conference from time to time.

The Association has a Scientific Research Committee which controls its research fund and publishes a journal entitled *Indian Medical Journal* which has a wide circulation in India and abroad. The present President is Dr. A. N. Roy.

Calcutta Mathematical Society

Attempts to organize a mathematical society were made as far back as 1883, but these did not materialize until the Calcutta Mathematical Society (92, Upper Circular Road) was founded in 1908 with 86 foundation members under the leadership of the late Sir Asutosh Mookerjee.

The society has undertaken to foster and encourage the study of mathematics in all its branches, to promote the spirit of original research, to arrange periodical meetings in which papers are read and discussed, and to investigate the history of various branches of mathematics with special reference to Indian and Arabian workers.

The first issue of the Society's publication, the *Bulletin of the Calcutta Mathematical Society,* came out in 1909 and since then is being published uninterruptedly every quarter. The Society is in exchange relations with almost all the mathematical and physico-mathematical societies of the world. It maintains a library containing these journals and reference books. The present President is Dr. H. Bagchi.

Indian Science Congress Association

The first session of the Indian Science Congress (1, Park Street) was held in the rooms of the Asiatic Society on January 14-16, 1914, with the late Sir Asutosh Mookerjee, as its first president. The session coincided with the centenary celebrations of the Indian Museum. As far back as 1910, Prof. P. S. Macmahon of the Canning College, Lucknow, and Prof. J. L. Simonsen of the Presidency College, Madras, brought forward a proposal for the foundation of an Indian Association for the Advancement of Science, the primary object of which was stated "to give stronger impulse and a more systematic direction to scientific enquiry, to promote the intercourse of societies and individuals interested in Science in different parts of the country, to obtain a more general attention to the objects of Pure and Applied Science and the removal of any disadvantage of a public kind which may impede its progress". The response to their circular letter issued in the autumn of 1911 being rather unfavourable, the sponsors decided to form a committee of 17 foremost men of science in India, which met at a conference in November, 1912 and resolved to ask the Asiatic Society to undertake the management of a Science Congress annually in Calcutta. The Society appointed a committee which worked out the details of the first session.

One hundred and five persons including members and visitors from various parts of India attended the session which, after the opening meeting, divided into a number of sections, *e.g.*, Chemistry, Physics, Zoology, Geology, Botany and Enthnography, and 35 papers in all were contributed.

With this small beginning the Congress has grown from year to year and it had on its rolls nearly 1300 Ordinary Members for 1950-51 and 1674 enrolled for 1951-52. 360 papers were contributed in 1951 January session to the 13 sections, *viz.*, Mathematics (22), Statistics (22), Physics (49), Chemistry (220), Geology and Geography (55), Botany (46), Physiology (23), Agricultural Sciences (14), Psychology and Educational Sciences (40), Anthropology and Archaeology (13), Engineering and Metallurgy (21), Zoology and Entomology (71), and Medical and Veterinary Sciences (34). Besides discussions are held on various subjects, sometimes in conjunction with two or more different sections.

The *Proceedings* of the Congress for the first 8 years were published as part of the *Proceedings of the Asiatic Society of Bengal.* With the ninth Congress, an independent volume appeared, the publication of which remained in the hands of the Asiatic Society till the twenty fourth Congress held in 1937.

The publication of the *Proceedings* from this year was taken over by the Science Congress and the proceedings since then are being published in four parts, *viz.*, Part I, Official Matter, Part II, Presidential Addresses, Part III, Abstracts, and Part IV, Discussions, list of members and index. From the same year the rules of the Congress were modified so as to make the body permanent and named as Indian Science Congress Association. The Association now consists of benefactors, honorary members, ordinary members (including life and sustaining members), full session members, associate members and student members.

The Congress celebrated its Silver Jubilee in Calcutta in 1938, in collaboration with the British Association for the Advancement of Science and prominent British and continental scientists were invited to attend the function, which was presided over by Sir James Jeans.

The Association played a leading role for organizing the National Institute of Sciences of India, inaugurated in 1935.

The Association is greatly indebted to the Asiatic Society, for providing rent free accommodation for its offices etc. since its foundation and excepting the years 1935-45 when the office was located at the Science College and Presidency College, Calcutta. In 1928 the Local Committee of the Calcutta session of the Association made over to the Asiatic Society a sum of Rs. 2,500/- only for creating an endowment for the award of a prize to be given to a person who has rendered conspicuous services to the Association. It has been awarded so far to Prof. M. N. Saha and Prof. S. P. Agharkar.

In 1951, the Pan-Indian Ocean Science Congress was held during the Science Congress session at Bangalore and 45 foreign scientists participated in these sessions. Earlier in 1946, foreign scientists from almost all countries attended the Science Congress session at Delhi and since then this contact with Indian and foreign scientists have become a permanent feature of the Association.

During the session, popular lectures, exhibitions and excursions to places of interest and entertainments are arranged by the Local Committee. In addition, learned bodies, hold their annual meetings.

The President-Elect is Dr. J. N. Mukherjee.

Association of Engineers

The aims and objects of the Association (24, Netaji Subhas Road), founded in 1919 are to develop the engineering science and engineering enterprises, to introduce and effect inventions, and to carry on researches in engineering and allied subjects.

The Association has introduced an examination for selection of candidates for corporate membership, of persons with varied qualifications. Such examinations are held according to syllabus adopted by well known institutions abroad and are held when necessary. The Association publishes a quarterly journal since 1925, containing articles on engineering subjects contributed by members and other eminent engineers. The total number of members on the rolls at present is 470. The present President is Sri S. Bandyopadhaya.

Institution of Engineers (India)

The Institution (8, Gokhale Road) was brought into being in 1920 for the purpose of bringing together all qualified professional engineers to promote the general advancement of engineering and engineering services in India and to utilize the engineering knowledge to the best advantage of the profession and to regulate and elevate the technical and general knowledge of persons engaged in engineering.

The Institution carries on its activities through the medium of 12 Local centres and a Committee in England. The headquarters of local centres are Calcutta, Bombay, New Delhi, Simla, Lucknow, Hyderabad (Dn.), Mysore, Patna, Nagpur, Madras and Travancore. The Institution is represented on the various technical Committees set up by the Government of India and State Governments and governing bodies of a large number of engineering schools and colleges in India. The Corporate Members of the Institution are Chartered Engineers (India). The Institution has recognized the degrees and diplomas of several engineering colleges in India and foreign countries as exempting from sections A and B of its Associate Membership Examination. It has framed a set of rules and syllabus of examinations which are held twice a year in May and November.

The Institute publishes a quarterly journal and awards annually the President of India prize of Rs. 500/- (in cash), Railway Board 1st prize consisting of a gold medal and Rs. 250/- (cash), and Railway Board 2nd prize of Rs. 250/- (cash) to the authors who contribute valuable papers to its journal. The present President is Shri K. C. Bakhle.

Indian Anthropological Society

The Society (35, Ballygunge Circular Road,) first came into existence in 1920 as the 'Anthropology Club' under the patronage of the late Sir Asutosh

Mookerjee and was confined to the members of the teaching staff and students of anthropology and allied subjects in the Calcutta University. In 1934, the name was changed to 'Anthropological Society, Calcutta University' ; and in 1949 its constitution was revised, membership opened to a wider circle and the Society renamed as Indian Anthropological Society.

The aims and objects of the Society are to promote and spread anthropological knowledge in the country, to encourage tribal and social welfare work and to encourage anthropological research and field work. The Society holds monthly meeting when papers are read and discussed, exhibitions, excursions and popular lectures. The present President is Prof. K. P. Chattopadhaya.

Indian Psycho-analytical Society

Founded in 1922 the Society (14, Parsibagan Lane) is affiliated to the International Psycho-analytical Association. The object of the Society is to study and spread the knowledge of the science of psycho-analysis as founded by Prof. Sigmund Freud. Any person who has been psycho-analyzed by a recognized psycho-analyst and takes an active interest in psycho-analysis is eligible for membership. Persons who are not psycho-analyzed are eligible for associate membership. Realizing the need of an institution for imparting training in psycho-analysis, the Indian Psycho-analytical Institute was started by the Society in 1930 and another training centre opened in Bombay in 1945. After the training the Institute grants a certificate to those who passes the examination which entitles the candidate to practice psycho-analysis. To provide greater facilities for training and research in psychiatry and psychological medicine, the Society started the Lumbini Park Mental Hospital in 1940 and a psychological clinic called Lumbini Clinic in 1948. The society publishes a quarterly journal entitled *Samiska*. The present President is Dr. G. S. Bose.

Bengal Natural History Society, Darjeeling

The Darjeeling Natural History Society established in 1923 was renamed as Bengal Natural History Society in 1940. The Society cannot be dissociated from the Natural History Museum, Darjeeling, which was first mooted in 1902 and the collections housed in a small building built for it in the Lloyd Botanic Garden. The present Museum building was completed in 1915. To foster the growth of the Museum, the Society was formed at the suggestion of H. E. Lord Lytton, the then Governor of Bengal, who promised financial aid to the Museum. The objects of the Society are to maintain the Museum, to promote the study of natural history, and to get together, as complete as possible, collections of natural history specimens from the districts of Darjeeling, Jalpaiguri and Sikkim State.

In 1926, a quarterly journal was started, containing both scientific and popular articles. Deputy Commissioner of Darjeeling is the (*Ex-officio*) Chairman of the Society.

Indian Chemical Society

Since the late Dr. P. C. Ray joined the Presidency College, Calcutta, a school of chemistry was gradually built up in India and a search in the literature shows that till 1916, about 126 papers were contributed by Indian workers to various journals abroad. In 1921, a committee was formed with Dr. E. R. Watson as the President to look into the possibility of organizing a Society. A circular letter issued by this Committee had an encouraging response. At the Chemistry Section of the 10th session of the Indian Science Congress held in Lucknow in 1923, a scheme was drawn up. The Society functioned with 101 fellows on its rolls since 1924, which rose to 448 in 1948. The Society's journal first appeared as quarterly in 1924, later changed to bi-monthly in 1928 and monthly since 1930. Since 1937, and in collaboration with the Institution of Chemists (India), a quarterly Industrial and News Edition of the journal has been published separately. The Society has on its rolls about 300 subscribers to its journal and receives 128 journals in exchange.

The growing needs of the Society eventually led to a generous gift of Rs. 10,350/- from Sir P. C. Ray, for building a house for the Society. The University of Calcutta allowed construction of rooms on the third storey of the University College of Science and Technology (92, Upper Circular Road) in 1933 and levied a nominal token rent of Re. 1/- per mensem.

The activities of the Society gradually expanded and branch societies were opened at Lahore (1925), Bombay (1926) and Madras (1927). The Society has inaugurated a lectureship and a medal each year in memory of its Founder-President Acharya P. C. Ray. Its present President is Prof. P. C. Guha.

Geological, Mining and Metallurgical Society of India

The Society (Geology Department, Presidency College) was started in 1924 by several geologists, mining engineers and prominent persons interested in mineral trade and business so that the scientists and technical and business men may meet together on a common platform to discuss matters relating to geology, mining and metallurgy. It has three branches *viz.*, Bengal and Bihar coalfields branch at Dhanbad, Mica Mines branch at Kodarma and Banaras branch at the Hindu University, Banaras.

The Society holds meetings at Calcutta when papers are read and discussed, arranges excursions to various places of interest and co-operates with the Government and industries concerned by offering its opinion on matters relating to mines and minerals. The Society has now on its rolls 444 members. It has a big library and receives 117 journals in exchange of its own from India and abroad. The publications of the Society include ***Quarterly Journal*** now in its 23rd volume and ***Bulletins*** on topics relating to mineral industries of India. The present President is Shri B. P. Agarwalla.

Indian Psychological Association

The aims and objects of the Association founded in 1925 are (92, Upper Circular Road) to promote psychology as a science and a means of promoting human welfare, to undertake psychological researches and to foster the growth of psychological studies throughout the country. The practical utility of psychology is now fully recognized by the general public, the industrialists and the Government. Education, mental hygiene and mental diseases are some of the fields where the help of psychology is considered indispensable. The Association publishes a journal entitled *Indian Journal of Psychology*. The present President is Prof. S. C. Mitra.

Institution of Chemists (India)

The Institution (Chemical Department, Medical College) was established in 1928 to create a professional body of chemists for serving the community and to raise the efficiency of the status of chemists. It is a body of well trained and experienced chemists and will hereafter admit Members, Associates and Fellows, who, by examination or otherwise, have proved their competence to practice chemistry as a profession. The Institution now consists of about 475 members and publishes a quarterly journal containing papers of general industrial interests. Besides, it publishes a quarterly Industrial and News edition under the joint auspices of the Indian Chemical Society. The Institution annually awards a medal to the author of the best paper published in its journal and also arranges a H. K. Sen Memorial Lecture. The members meet from time to time for some talk of topical interest and goes out on excursions to mills, factories and other organizations. The Institute maintains a library. The present President is Dr. J. N. Mukherjee.

Indian Medical Association (Calcutta Branch)

The medical practitioners of India for a long time felt the need of an Association that would protect their interests and the future of the medicine and the health in the country. Sporadic attempts were made in the 19th century when two conferences were held in Bombay and at Calcutta and subjects of academic interest discussed. At the fifth conference of the Bengal Medical Association (now defunct) in Calcutta in 1928, it was resolved to form an All-India Medical Association to look after the interests of medical education, public health and the medical profession in India. In 1930, the Association was renamed the "Indian Medical Association".

The Association had its own monthly journal called "Indian Medical World", and the name was subsequently changed in 1931 to the *Journal of the Indian Medical Association*. The Association started with 222 members and has now over 11,000 members on the roll with 17 provincial and 316 local branches. It holds an annual conference. The Bengal branch of the Association was inaugurated in 1931 with activities limited to Calcutta and suburbs. The Bengal Provincial branch of the I.M.A. was started in 1935 which organized the medical profession and started branches at Calcutta, Barrackpore, Darjeeling, Comilla, Dacca, Faridpur and Jalpaiguri. The Calcutta branch has more then 1,000 members on its roll. The Association's All-India headquarters is at Corporation Place, Calcutta, and the Calcutta branch is at 67, Dharamtala Street. The present President is Dr. J. C. Banerjee.

Himalayan Club

The Club (P. O. Box No. 9049, Calcutta, 16) was inaugurated at a meeting held in Delhi on February 17, 1928, although the idea of a Himalayan Club to foster knowledge of the Himalayas goes as far back as 1866. The founder members, 127 in all, were men who had done things in the Himalayas. The aims and objects of the Club are to encourage and assist Himalayan travel and exploration and to extend knowledge of the Himalayas and adjoining mountain ranges through science, art, literature and sport. The Club's membership totals approximately 500. There are Honorary Local Secretaries at Bombay, Darjeeling, Dehra Dun, Delhi, Kulu, Pakistan and United Kingdom. The Club publishes *The Himalayan Journal* which comes out approximately once a year.

Bengal Tuberculosis Association

The failure to procure a bed for a girl suffering from tuberculosis in any of the Calcutta hospitals led to the starting of this Association (8, Lyons Range, Calcutta) in 1929, by the initiative taken by Mrs. Florence Becker, an American lady The Association with limited resources opened 10 clinics in Calcutta and mufassil. In 1939, an appeal was issued all over India by Lady Linlithgow and a sum of Rs. 8,000,000 was raised of which Bengal got its share of Rs. 7,57,801 In the meanwhile the Tuberculosis Association of India was organized and to which the Bengal Association became a branch. A Seal Sale Campaign was held in 1950 and 1951 in collaboration with the Tuberculosis Association of India to raise funds for the Association.

The objects of the Association are the study and prevention of tuberculosis and treatment of the patients at its clinics. When patients are unable to attend clinics, they are attended at home. Lectures with models and charts are also arranged with the help of lanterns and cinema films in public places, to spread the knowledge on prevention of the disease. The Association publishes a bi-monthly journal called the *Journal of the Bengal Tuberculosis Association*, dealing with all aspects of the disease in popular language both in English and in Bengali. Booklets and leaflets written in Bengali are also widely distributed free for the education of the mass. The present President is H. E. Dr. H. C. Mookerjee.

Bengal Pharmaceutical Association

In 1929, the compounders of Bengal formed themselves into an Association (7, Lower Rawdon Street) under the name of All-Bengal Compounders' Association, for the improvement of the training of compounders and their status. In

1934, Lt. Col. R. N. Chopra presided over its 5th annual conference, when it was renamed and re-constituted for promotion of the science and art of pharmacy in all its different branches and research work. The Association pressed the Government for drugs and pharmacy legislation in the country and the Drugs Act was passed in 1940. The Pharmacy Bill was introduced in the Assembly in 1946. The Association is also helping in the deliberations of the College of Pharmacy Committee of the Government of West Bengal. The activities of the Association received a set back due to World War II, and a revival was effected with the fourth pharmaceutical conference held in 1948, when it was converted into a professional body. The Association publishes the *Indian Pharmacist* which is devoted to the cause of pharmaceutical education and drugs industry in the country. The present President is Sri M. L. Schroff.

Geographical Society of India

The Calcutta Geographical Society (Department of Geography, Senate House) was formed in 1933 by a small band of workers with the object of supplying the need of a central organization for the increase and spread of geographical knowledge in India. The Society was renamed and its activities extended widely in 1950. The Society publishes a quarterly journal known as *Geographical Review of India* (formerly *Calcutta Geographical Review*) and *Bulletins* of special interest. 7 bulletins have been issued so far. The Society received munificent donations from Dr. B. C. Law, with which it could publish its *Journal* and *Bulletins*. The Society also convenes meetings, organizes exhibitions and maintains a library. The present President is Prof. S. P. Chatterjee.

India Society of Engineers

The Society (12, Netaji Subhas Road) was established in 1934 with the object of securing for the men in scientific and engineering professions a recognition and a bonafide status in their professional life and also of affording them the benefit of collective wisdom and organized existence.

The activities of the Society include holding of lectures and visits; maintenance of a Special Service Library and Reading Room for the members and the public; and maintenance of an Information Bureau. The Society has on its rolls 1524 Corporate Members, of which 368 are Ordinary and 1156 Associate Members. It also provides for graduateship, licentiateship and studentship for various categories of students. The Society publishes a monthly journal entitled *Science and Engineering*. It has also published six technical books written by well known authors. The present President is Dr. B. N. Dey.

Physiological Society of India

The aims and objects of this Society (92, Upper Circular Road) are to promote physiological, biochemical and allied studies and researches in India and to facilitate intercourse of physiologists with experts in allied lines of investigations. The Society started in 1934 with 32 members on its rolls, which has now risen to 117. It regularly holds meetings and symposia. During the first few years of its existence, the Society published 3 bulletins. Since 1947 it started its regular publication entitled *Indian Journal of Physiology and Allied Sciences* twice in a year, and is now published quarterly. A branch society was opened at Patna in 1942 with 16 members. The present President is Dr. S. K. Sen.

Society of Biochemistry & Experimental Medicine

The Society (92, Upper Circular Road) originally founded in 1934 as the 'Biochemical Society', was re-named in 1941 to bring together the men of the medical profession on a common platform with the biochemists, organic chemists and physiologists. The Society started with 33 members has now about 90 members on its rolls. It arranges monthly meetings for reading of papers etc. and abstracts of such papers are later published in the Society's *Proceedings*. In the absence of any other publication the members receive free copies of the *Annals of Biochemistry and Experimental Medicine*, published by the Indian Institute of Medical Research at Prinsep Street, Calcutta, by arrangement.

Indian Physical Society

The Indian Physical Society (2 & 3, Lady Willingdon Road, Jadavpur) formed in 1934, came into existence through the efforts of a group of physicists including Profs. D. M. Bose, B. M. Sen, M. N. Saha, P. N. Ghosh, S. Datta, S. K. Mitra, B. B. Ray and others. The aims and objects of the Society are to promote the progress and uphold the cause of physical science in both pure and applied branches in India and to publish important researches in physics and to co-operate with other organizations having similar objects. The Society arranges periodical scientific meetings and symposia in which original work in physics are read and discussed and lectures on modern developments in physics are delivered by eminent physicists. The members of the Society receive the *Indian Journal of Physics*, published by the Indian Association for the Cultivation of Science, in collaboration with the Society. The journal has acquired a high international reputation and has wide circulation in India and abroad. The Society's present membership is about 150. The present President is Prof. S. K. Mitra.

National Institute of Sciences of India

(*Publication Section*)

The National Institute of Sciences of India (1, Park Street) was founded on January 7, 1935 at a meeting held in Calcutta under the Chairmanship of Dr. J. H. Hutton, General President, Indian Science Congress. The Institute is a senior body of scientists for effecting co-ordination between scientific academies and societies and for the promotion of the cause of science in India. The Institute earned the recognition as the premier scientific organization in India by the Government in 1945. The headquarters of the Institute was transferred from Calcutta to Delhi in 1946 and removed to its own building on October 6, 1951. The office of the 'Publication and Despatch Section' of the

Institute, however, still continues to remain in the premises of the Asiatic Society, Calcutta. Besides the Editor of Publications and the Asst. Editor, there is a Publication Advisory Board in Calcutta. Regular publications of the Institute include (1) a bi-monthly *Proceedings* (size royal octavo) and (2) *Transactions* (size quarto). The Institute also published "Indian Science Abstracts" from 1935, being a bibliography of Science in India. This publication was suspended in 1939 due to World War II. To bridge the gap, a supplement to "The Progress of Science in India during the past Twenty-five years" (published by the Indian Science Congress Association), covering the period 1939-1950 is to be published and thereafter it will be an annual publication. Papers read at the symposia are to be published hereafter in separate *Bulletins*. The present President is Rai Bahadur Dr. S. L. Hora.

Indian Science News Association

The main object of this Association (92, Upper Circular Road) founded in 1935 is to popularize and disseminate the knowledge and progress of modern natural and cultural sciences, and publication of journals and books, both in English and Vernacular, in furtherance of the aforesaid objects. Uptil now the activities have been primarily concentrated in conducting a monthly journal of general science, applied sciences and science news and reviews, named *Science and Culture*. The journal is run on a non-profit basis by the unflagging missionary efforts of the editors. Besides popularizing science, the Association, through its journal, has ever insisted on the social aspects of science and on the application of science in national undertakings. The journal has thus not only brought together isolated workers in the different branches of general and specialized science but has also helped to mould public mind and governmental policies on such major issues as scientific education, national economic development and State aid to research, national laboratories, river valley projects etc. The Association has thus served the cause of the advancement of science and industry in this country. The Association receives 70 journals (40 Indian, 30 foreign) by exchange which has formed the nucleus of a library. The present President is Prof. M. N. Saha.

Botanical Society of Bengal

The Natural History Club, Calcutta, (35, Ballygunge Circular Road,) founded in 1921 at the Biological Laboratories of the Calcutta University by the late Dr. P. Brühl and others provided a forum for exhibiting botanical, zoological, geological and anthropological specimens and reading of papers on these subjects for more than a decade and later became defunct. To remedy this lacuna in Calcutta's scientific field, botanists of Bengal who attended the session of the Indian Science Congress in 1935 conceived the idea of founding a Society which was inaugurated on December 13, 1935. The aims and objects of the Society are to promote a feeling of fellowship among the botanists in Bengal, holding meetings for communicating results of original investigations carried out by members, popular lectures, symposia, botanical exhibitions and excursions. The Society's publications include a *Bulletin* published twice a year since 1947, special publications (3 such published so far), and a Laboratory Note Book for the guidance of the under-graduate students in botany and biology. The present President is Dr. J. C. Sen Gupta.

Indian Anthropological Institute

The Institute (Indian Museum) was established in 1936 for the advancement of anthropological research in India, popularizing anthropological knowledge and collection of ethnographic materials. The Institute's progress was hampered during World War II for a variety of reasons. It has so far restricted its activities to occasional discourses and meetings and publication of its Journal since 1938, containing papers of original research in anthropology and allied sciences, a new series of which commenced in 1948. The present President is J. P. Mills, Esq.

Bengal Obstetric and Gynaecological Society

The aims and objects of this Society (91B, Chittaranjan Avenue) founded in 1936 have been the promotion of knowledge in obstetrics, gynæcology and allied subjects, cultivation of fellowship among its members and creating public opinion in matters relating to maternity and child welfare. *The Journal of Obstetric and Gynæcology of India* is being published quarterly jointly with the Federation of Obstetric and Gynæcological Societies of India. The present President is Dr. M. N. Sarkar.

Indian Chemical Manufacturers Association

The Association (23-B, Netaji Subhas Road), inaugurated on the 16th July, 1938 by the late Acharya P. C. Ray, the Founder President, is an organization of manufacturers of chemical, pharmaceutical and allied products in India, and has now 105 members representing diverse interests. Of the industries represented, pharmaceuticals lead, being followed by sulphuric acid, superphosphates, soaps etc. The Association acts as the spokesman of the Indian chemical industry before the Government and the general public. It also aids close co-operation between member manufacturers and provides information to those interested in the chemical industry. The publications of the Association include, Annual Report, occasional newsletters and circulars and bulletins. A review of the growth and development of chemical industry is now under preparation. The present President is Dr. L. A. Bhatt.

Zoological Society of India (Calcutta Branch)

The Society (Indian Museum) owes its inception to a resolution passed at the Zoology Section of the Silver Jubilee session of the Indian Science Congress, held at Calcutta in 1938, and the Indian Zoological Society was formed in 1939. For various reasons the Society did not function until it was revived, re-named and a new constitution adopted in 1946, with the object of the promotion of zoological knowledge in all its aspects. Four or more members may form a local branch and the Calcutta branch with 45 members holds meetings and exhibitions The *Journal of the Zoological Society of India* is published half-yearly, the first number of which appeared in January, 1949. The present Chairman is Rai Bahadur Dr. S. L. Hora.

Science Club

Scientific workers employed in the academic and industrial institutions in Calcutta, formed the Club (22, Ramesh Mitter Road) in 1940 with the object of promoting social and cultural fellowship and cultivation of goodwill among its members. The Club holds monthly meetings and symposia where scientific and industrial subjects are discussed and also social meetings. It publishes a quarterly journal entitled *Journal of the Science Club.* The Club has started a Science Club Movement to help the schools and colleges to organize science clubs among students and to enable them to have a picture of the impact of science on our economic and social life. The present President is Dr. K. R. Sen.

Engineering Association of India

The Association (23-B, Netaji Subhas Road), established in 1942 represents the engineering and allied industries of the country in its various branches. It has on its rolls 210 members representing iron and steel, non-ferrous metal, mechanical and electrical engineering industries etc. It renders service to the industry as a whole in its dealings with the Government and also helps individual firms in their enquiries and difficulties. It expresses the view of engineering industrialists on questions relating to industrial legislation, factory acts, tariffs, taxation, technical education etc. The Association publishes annually *Engineering News of India* in addition to various reports and pamphlets from time to time. The present President is Shri P. R. Bagri.

Indian Decimal Society

Founded in 1944, the objects of the Society (29-1A, Baldeopara Road) have been to popularize a scheme of the Decimal System for standardizing coins, weights and measures. It has published so far ten pamphlets for educating the Government and the public on the usefulness of the decimal system. Its other contributions were published in various periodicals of the country. A bill for the decimalization of the coinage introduced in the Indian Legislature was postponed for eliciting further public opinion and for simultaneous introduction of decimal system in coinage, weights and measures. The suggestions originally made by this Society for the decimalization of weights and measures, conform with the report of the Indian Standards Institution on this subject. The Chairman of the Advisory Board is Dr. H. L. Roy.

Calcutta Statistical Association

The Association (Ashutosh Building) was started in 1945 with the object of promoting the cause of statistics in post-war India in all possible ways. It has directed its efforts towards educating the Government and the public on the usefulness of reliable statistics and their dispassionate analysis in solving the diverse problems of national life. The Association has published popular exposition of statistical methods and critical discussions of statistical projects undertaken in India, helped statistical research by organizing seminar discussions and lectures on theoretical and applied statistics etc. The Association brings out a quarterly publication entitled *Calcutta Statistical Association Bulletin.* It also published a glossary of statistical terms in Bengali. The present President is Sri A. R. Sinha.

Indian Institute of Metals

The Institute (23-B, Netaji Subhas Road), founded in 1946 provides a forum for the Indian metallurgists for the exchange and dissemination of metallurgical engineering thoughts and ideas and for the promotion and advancement of the study and practice of the art and science of making, shaping and treating of metals and alloys. The Institute's membership roll exceeding 350 includes enrolment from U.K., U.S.A., Canada and Germany. It has already opened three branches at Bangalore, Jamshedpur and Poona. Meetings where problems on the production, substitution and preservation of metals and other alloys are discussed are held at Calcutta and at the branches. It also organizes symposia. The Institute publishes its own *Transactions,* four volumes of which have already appeared. It has a reference library and receives publications in exchange of its *Transactions* from all parts of the world. The Institute awards a Gold Medal, named Kamani Gold Medal, every year to the author of the best technical paper published in its *Transactions.* The members also receive free of cost, a weekly journal entitled *Metal Market Review.* The present President is Sri Padamji P. Ginwala.

Zoological Society of Bengal

The absence of any active organization where zoologists could meet and discuss their problems, led the zoologists in Calcutta to form this society (35, Ballygunge Circular Road) which was inaugurated on January 17, 1946. The Society holds meetings for reading and discussion of scientific facts and popularize the subject by holding exhibitions, popular lectures etc. Since 1948, the Society is publishing its own *Proceedings* twice a year and has built up a reference library by exchange from all parts of the world. It has also published a Laboratory Note Book for the guidance of under-graduate students in zoology and biology. The Society has 300 members on its rolls from all States of India and abroad. The present President is Prof. H. K. Mookerjee.

Cardiological Society of India

Members attending the Bengal Provincial Medical Conference in 1946 and those interested in cardiology formed a Cardiological Society of Bengal in 1946 which was later converted into an All-India body in 1948. The headquarters is at 67, Dharamtala Street. The aim of the Society is advancement of scientific knowledge about cardiovascular systems in all its aspects. Its activities include organization of refresher courses and scientific meetings and publication of the *Indian Heart Journal,* appearing three times a year since 1949. The Society was able to grant research fellowships of the value of Rs. 10,000 to workers in cardiology in different parts of India. The present President is Prof. T. K Raman.

Indian Psychiatry Society

The dwindling of the activities of the Indian Division of the Royal Medico-Psychological Association of Great Britain, with about 40 members, and the changed political situation of the country led to the formation of this Society in January 1947. The aims and objects of the Society are to raise the quality and status of psychiatry in India and to establish fellow feeling amongst the psychiatrists, neurologists and other persons interested in this branch of medicine in India. It holds general meetings in different parts of India, in which papers on neurology, psychiatry, psycho-analysis and allied sciences are read and discussed. The Society has been publishing a quarterly journal entitled ***Indian Journal of Neurology and Psychiatry*** since 1949 (128B, Dharamtala Street). The present President is Lt.-Col. B. Bhattacharya.

Indian Institute of Chemical Engineers

The need for establishment of a professional body was keenly felt by all sections of chemical engineers connected with educational institutions or industry and a start was made in Patna on December 31, 1947 prior to the 35th session of the Indian Science Congress. The objects of this Institute (37, Grosvenor House) have been to promote the advancement of chemical engineering science, by holding technical meetings and publishing its own ***Transactions*** containing the papers read and accepted for publication. The present President is Dr. R. R. Hattiangadi.

Bengal Radiological Association

The Association (4, Cooper Street) founded in Calcutta in 1948 is a branch of the Indian Radiological Association, established in 1931 by a handful of medical men practising radiology in the city. The aims and objects of the association are to foster the growth of radiological practice and radiological industries in India by holding of annual conferences. Two sessions were organized in 1948 and 1951. Besides, it holds clinical and general meetings and exhibitions for discussion of topics and demonstration of films, techniques etc. on medical radiology.

The parent organization founded a lectureship, in memory of Acharya Jagadish Chandra Bose, which carries a gold medal for lecture on a subject pertaining to medical radiology. The Association publishes a quarterly journal entitled ***Indian Journal of Radiology***. The present President is Dr. K. B. Ghose.

Bangiya Bijnan Parishad

The Parishad (93, Upper Circular Road) which was inaugurated on January 25, 1948 has in view the idea of developing and fostering in the people of the

State a scientific attitude of life through popularization and dissemination of scientific knowledge, by publishing magazines, books, and organizing lectures, film shows etc. in the language of the State. The publications of the Parishad include a monthly journal *Jnan O Bijnan*, books in *Loke Bijnan Series* (six numbers published so far), *Bijnan Prabesh Series* (three numbers published so far), and reprints of valuable treatises. The Parishad has more than 1,000 members on its rolls. The present President is Prof. S. N. Bose.

Indian Society of Refrigerating Engineers

The Society (12, Kyd Street) was founded in 1948 for the promotion of the science and practice of refrigerating and air conditioning engineering and protecting the interests of those engaged in this profession. It has its own publication entitled *Journal of the Indian Society of Refrigerating Engineers* published twice a year. The present President is Sri M. K. Khanna.

Indian Pediatric Society

The Society (56/2, Creek Row) was founded on December 28, 1948 with the object of promotion and advancement of pediatrics and allied subjects. It is a founder member of the International Pediatric Association of Zürich, Switzerland. It arranges scientific lectures and demonstrations and considers questions affecting improvement of child health in all its aspects. It has prepared a blue print for a Child Health Institute of the higher standard and taken steps to implement it. Through its quarterly publication, *Indian Journal of Pediatrics*, the Society is making available to its readers information on the progress made in child care and on research and progress in pediatrics from all over the world. The Society has a library of about 5,000 volumes and receives 75 technical journals (Indian and Foreign) on child health. The present President is Dr. M. B. Prabhu.

Association of Dermatologists and Venereologists

Founded in 1948 (67, Dharamtala Street), the aims and objects of the Association are to promote the study and research in dermatology and venereology and to cure and prevent these diseases in all their aspects.

The Association holds clinical lectures and case demonstrations in co-operation with the W.H.O. It held an All-India Conference in April, 1951, which was attended by delegates from all over India. It has also published a *Journal*. The present President is Lt. Col. K. K. Chatterjee.

Anatomical Society of India

The demand for having an Anatomical Society was keenly felt as the workers in the line increased with a rapid growth of Medical Colleges in India from 4 in 1914 to 30 in 1951. The object of the Society (Nilratan Sarkar Medical College) has been to discuss the various problems of research and teaching in anatomy specially human anatomy and of general advancement of the subject in India. The Society was inaugurated on May 20, 1951 with more than 100 anatomists, surgeons, physicians, radiologists and other medical and biological scientists including veterinarians as founder members. The Society holds general meetings for scientific discussions, exhibitions, orations, and publishes a *Journal* twice a year. The present President is Prof. A. A. Ayer.

B. Cultural

Calcutta University Institute

The Institute (7 Bankim Chatterjee Street) was organized under the name of "Society for the higher training of youngmen" by Rev. Protap Ch. Mozoomdar and other leading educationists of the time, and formally inaugurated at the Town Hall, Calcutta, on August 31, 1891. It was re-named Calcutta University Institute in 1896.

The objects of the Institute have been for the moral, mental and physical improvement of young men and the promotion of literature and fine arts, the diffusion of useful knowledge, maintenance of libraries and the administration of charity funds. The Institute is the first of its kind where students of different colleges in Bengal irrespective of caste, creed or community, can meet together for their mutual benefit. The Institute had a membership of 180 (including 48 senior members) in 1891, and the highest number ever recorded being 2,908 in 1914.

The Institute was originally housed in the premises of the Hindu School and the present building containing a library, a free reading room, a big hall, gymnasium etc. was opened on April 6, 1916, with the help of a grant of Rs. 3 lakhs from the Government and other private benefactions.

The Institute has organized from time to time inter-college recitation competition, essay competition, fine arts exhibition, Oriental music competition, debating competition, etc. and staged several dramas which have a unique place in the history of the stage in Bengal. In 1939, the Institute started the adult education campaign through 280 centres in Calcutta and the mufassil. The present President is Maharaja Sris Chandra Nandy Bahadur of Cossimbazar.

Maha Bodhi Society of India

The Society (44, Bankim Chatterjee Street) was founded in 1891 by the Anagarika Dharmapala of Ceylon, the greatest Buddhist missionary of modern times, who received great inspiration under the Bodhi tree at Buddhagaya where Lord Buddha attained enlightenment 2,500 years ago. The late Sir Asutosh Mookerjee was its founder president. The objects of the Society include restoration of the sacred places associated with the life work, and the propagation of the message, of Lord Buddha. Centres and branches have been established at

Sarnath, Buddhagaya and other places of sanctity where temples, educational institutions, libraries, orphanages, and dispensaries are maintained as a part of the Society's cultural and humanitarian activities. The membership of the Society is spread all over the world. The Society has brought together Buddhist countries of the world in closer contacts with India. The publication of the Society include an english monthly *Maha Bodhi,* a hindi magazine entitled *Dharmaduta* (published from Sarnath) and other literature on Buddhism in various Indian and foreign languages. The present President is Dr. S. P. Mookerjee.

Bangiya Sahitya Parishad

The Parishad (243/1, Upper Circular Road) was inaugurated at a meeting held on July 23, 1893 and named 'Bengal Academy of Literature' with late Ramesh Chandra Dutt, I.C.S., as its first President. It was re-named as Bangiya Sahitya Parishad in 1894. The object of the Parishad is advancement of the Bengali language and literature. By 1900, Parishad had on its rolls 523 members. In the same year, the Parishad received a gift of 7 cottahs of land from Maharaja Manindra Chandra Nandi Bahadur of Cossimbazar and it took another 8 years to raise funds for building the Parishad's present premises where it shifted in 1908. Raja Jogindra Narayan Rai of Lalgola, later donated a sum of Rs. 10,000 for the construction of the 1st floor of this building. In 1914, the Maharaja of Cossimbazar made a second gift of 7 cottahs of land. The Gaekwar of Baroda donated a sum of Rs. 5,000 for the construction of a building, erected in memory of late Ramesh Chandra Dutt. The Parishad also maintains the residence of late Bankim Chandra Chatterjee at Naihati, which is named as "Bankim Bhaban".

The Parishad established 30 branches in Bengal and other States of which the branches at Rangpur, Bhagalpur, Midnapore, Meerut, Krishnagore, Uttarpara, Burdwan, Shillong, Ranchi and Naihati are still functioning.

Since 1909, the Parishad, at the instance of Rabindra Nath Tagore, organized an annual conference of Bengali literatures, which resolved into sections on literature, philosophy, history and science, each having its own president. The first conference was held at Cossimbazar with Rabindra Nath Tagore as General President and Acharya Prafulla Chandra Ray as President of the Science Section.

The Parishad has a big library containing rare books and manuscripts and a museum of coins and sculptures. The Parishad has undertaken the publication of rare and out of print books in Bengali literature and has published the works of Acharya Ramendra Sunder Trivedi, Bankim Chandra Chattopadhaya, Michael Madhusudan Dutt, Raja Rammohan Roy, D. L. Ray and others. 80 volumes containing reprints of works by renowned literateurs have so far been published after suitable editing. A series of life sketches of the literateurs of the nineteenth century, who are regarded as the creators of the modern Bengali language and literature are being published in the series "Sahitya Sadhak Charitmala". Biographies of 107 scholars have so far been published in this series.

The Parishad's regular publication known as *Sahitya Parishad Patrika* which is now in its 58th year and published quarterly, contains articles on ancient Bengali literature, folk-lore, description of manuscripts, phonetics, modern literature, sanskrit literature, history and archaeology, philosophy and science, including scientific terminology (*paribhasha*). The Parishad holds more than 12 trust funds for the award of medals and prizes to literateurs. The present President is Maharaja Sris Chandra Nandy Bahadur of Cossimbazar.

Calcutta Historical Society

Founded in 1907, the aims and objects of the Society (12/1, Old Post Office Street) are (*a*) historical researches relating principally to Bengal, Bihar and Orissa, (*b*) preservation of ancient and historical institutions, places, temples, monuments etc. and (*c*) promotion and encouragement of the study of the history of Calcutta and its environs. The Society's journal *Bengal—Past and Present*, which was formerly a quarterly is now published annually. The present President is Sir Jadunath Sarkar.

Ramakrishna Mission Institute of Culture

The Institute (111, Russa Road) established in 1937 has as its aim the revival and propagation of Indian culture which have for long lain dormant and for the establishment of cultural relations with other countries. Classes on Indian Scriptures and literature, lectures on social, religious and cultural topics, international symposia, where Indian and Western scholars meet on a common platform, are the regular features in the institute's programme of work. It has a big library containing 20,000 volumes on subjects of cultural importance and a reading room containing various journals. The Institute's publications include "The Cultural Heritage of India", published in 3 volumes in 1937, which is now being revised and enlarged in 7 volumes. It has a monthly *Bulletin* containing the records of its current activities.

Bangiya Itihas Parishad

The Parishad (2A, College Square) is the outcome of a decision taken at an informal meeting of Bengalee historians and scholars assembled at Cuttack, during the 1949 session of the Indian History Congress, and was inaugurated in January 1951 with the object of encouraging historical studies, discussion and research through the medium of the Bengali language and to arouse a historical consciousness in its widest sense amongst the Bengali speaking public. The Parishad organizes monthly meetings, lectures and discussions in Bengali and debating and essay competitions specially among students. The Parishad publishes a quarterly journal *Itihas* in Bengali which has just entered the second year of its publication. The present President is Dr. R. C. Majumdar.

C. Miscellaneous

Indian Journalists' Association

The Association (249-B Bowbazar Street) was inaugurated in 1922, at a time when the liberty of the press was frequently threatened. It was converted into an All-India body in 1935. The objects of the Association include maintenance of contact with international body of journalists, establishment of clubs, reading rooms, holding of meetings and conferences etc. In 1931, the Association took a leading role for teaching in journalism which resulted in the introduction of a diploma course in journalism in the Calcutta University in 1951. The number of members on its roll is 310. The Association is publishing a quarterly journal entitled *Indian Recorder* since 1932, containing register of events and statistics. The present President is Sri Vivekananda Mukherjee.

West Bengal College and University Teachers' Association

The objects of this Association (13, Mirzapore Street), established in 1926, are to study all problems of education in general and collegiate and university education in particular and to promote the interests of its members who are all bonafide teachers of the University and its affiliated Colleges. The Association holds an annual conference and meetings of its committees to discuss problems of education in general and causes of educationists in particular. It publishes a *Bulletin* from time to time. The present President is Dr. S. P. Mookerjee.

Association of Scientific Workers of India (Calcutta Branch)

The formation of this Association (92, Upper Circular Road) is the outcome of the lead given by Prof. Meghnad Saha in 1946 and the Association was inaugurated on January 7, 1947 at Delhi under the auspices of Indian Science Congress with Sri Jawaharlal Nehru as President and with headquarters at Delhi to work for the most effective use of science and scientific methods for the benefit of the society as a whole and to protect and improve the status and economic condition of scientific workers. The Association has since then organized branches in Calcutta, Patna, Delhi, Bombay, Naihati and Raniganj. The Calcutta branch has constituent units at the Mathematical Instruments office, the School of Tropical Medicine, and the University College of Science and Technology. The Association is propagating scientific knowledge by film shows, popular lectures, symposia etc. A monthly journal entitled *Vijnan-Karmee* is published from the headquarters. The present President is Dr. C. R. Das Gupta.

In addition, to the Societies briefly described above there are several other bodies of various categories engaged in pursuit of knowledge in their respective branches, and a detailed account of these we are unable to give for limited space at our disposal for this Section of the volume. Mention may be made of:

Iran Society (159B, Dharamtala Street) ; *Photographic Association of Bengal* (24B, Hindusthan Park); *Bengal Library Association* (Central Library, C.U.) ; *Indian Mining Federation* (135, Canning Street) ; *Academy of Fine Arts* (Indian Museum); *Institute of Oriental Learning* (3 Federation Street); *Shakespeare Society* (Bangabasi College); *Shaw Society* (David Hare Training College); *Bharati Tamil Sangham* (93/A, Rashbehari Avenue); *Bengal Theosophical Society* (4/3, Bankim Chatterjee Street); *All-Bengal Teachers' Association* (15, Bankim

Chatterjee Street); *West Bengal Adult Education Association* (College Square); *Immunity Scientific Association* (39, Lower Circular Road); *Patent Office Society* (214, Lower Circular Road); *All-India Astrological and Astronomical Society* (105, Grey Street); *Romak Lipi Samiti* (29-1/A, Baldeopara Road); etc.

SECTION VII

TRADE AND INDUSTRIES

Trade and Industries of Calcutta

Introductory

CALCUTTA is the nerve-centre not merely of commercial West Bengal, but practically of the entire north-eastern India. Though some of the more important industries which have contributed to the importance of Calcutta as a commercial centre are situated outside the limits of the city, it can, on its part, certainly claim to have considerably helped the development of these industries by providing various facilities necessary for the purpose. Situated on the bank of a great river and eighty miles from the sea, it has a fine port connecting it directly with the rest of the world and also facilitating the handling of a large volume of coastal and inland river trade. Two of the great railway systems of India terminate on the other side of the river. Previous to Partition, the city was the terminus of yet another railway system, and though the major part of the latter has fallen outside the Indian Union, the connection with East Pakistan and, through it, with Assam remains. Calcutta also provides air link with practically all the important countries of the world, being, in addition, in the direct line of air communication between South East Asia and the Southern Pacific on the one side and the Middle East and Europe on the other. In fact, the entire trade of north-eastern India with foreign countries and a major part of its internal trade passes through Calcutta which also provides all facilities such as banking, insurance, storage, marketing, handling and power that are necessary for the proper functioning of the system.

Tea, mining, jute, engineering and cotton textile are the more important of the industries of the area, but the gardens, mines and mills are situated in almost all cases outside the city area. Of these, however, jute and cotton mills are situated in an area on both sides of the Hooghly to the north and south of Calcutta extending over about 45 miles in length and an average width of less than 2 miles. This area has also a large number of other industries, such as paint, paper, glass, rubber, matches. chemicals, iron and steel re-rolling engineering, brick-fields, railway workshops, dockyard, shell factory, generation of power, flour mills, rice mills, oil mills, hosiery, silk, pottery and cement, soap, tobacco etc.

It should not, however, be understood that there are no industrial concerns in Calcutta proper. As a matter of fact, some of the jute mills are actually situated within the city limits which also contain a number of jute presses, engineering, glass, pottery, chemicals, soap, rubber, matches and hosiery concerns, flour, rice and oil mills, and printing presses, type-foundries, publishing houses and newspapers and cotton ginning factories.

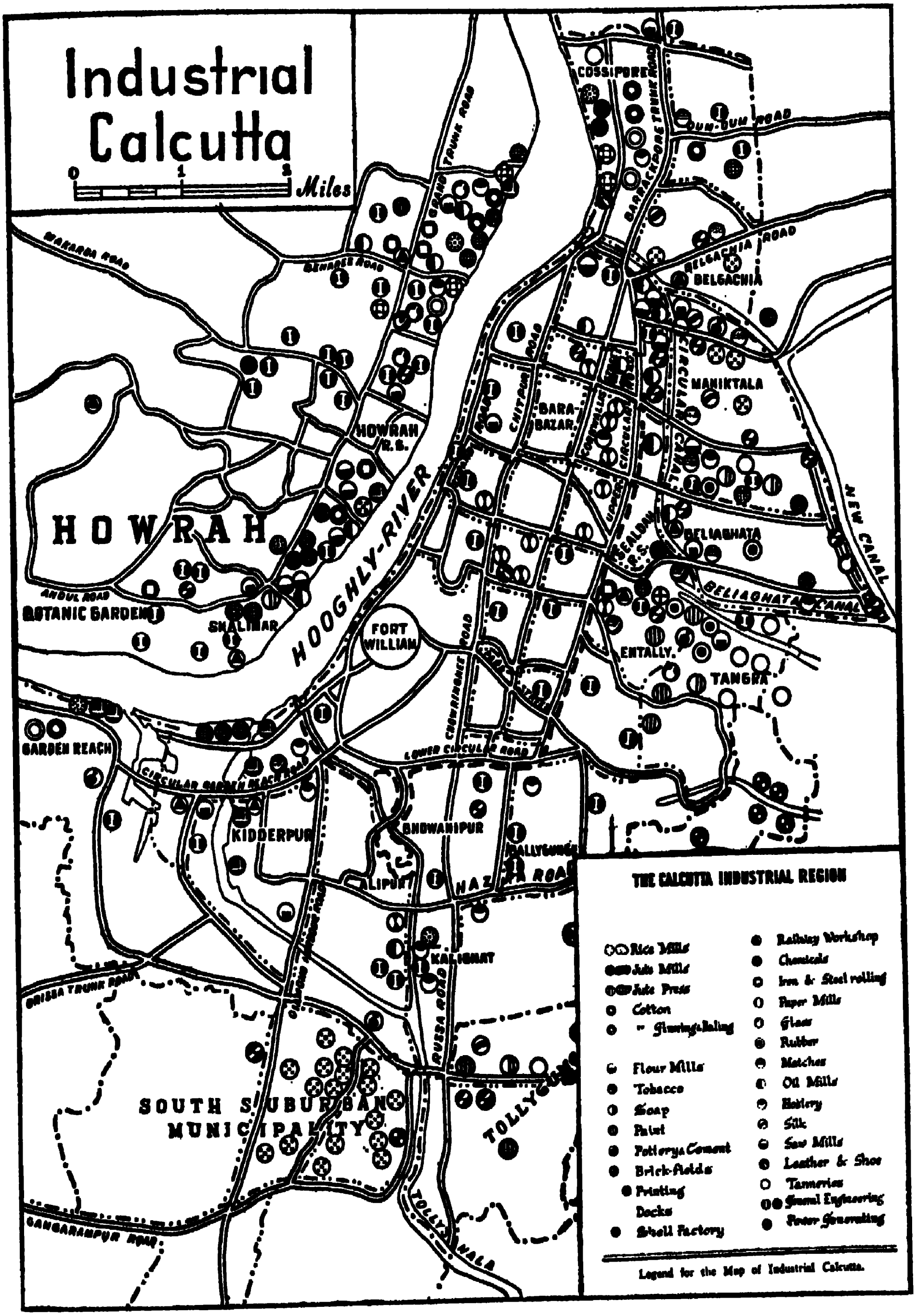
Practically, all these industrial concerns are being managed, controlled and financed from Calcutta. Even the tea gardens which are situated in North Bengal, Tripura and Assam, and the collieries in the Bengal-Bihar coalfields, far away from Calcutta, have their head offices in the city.

The total number of industrial concerns (except coalfields and plantations) in West Bengal, and the whole of India, as in 1947, together with other relevant information, is given below:

	Number of registered factories:	Total capital employed (in lakhs of rupees)	Number of persons employed (including supervisory and clerical staff)	Total value of products and by-products (in lakhs of rupees)
India	5,643	4,04,00	16,33,553	7,43,61
West Bengal	1,316	1,06,55	5,24,202	2,16,16

No separate figures are available for Calcutta, but it may safely be stated that by far the largest number of factories of West Bengal are situated in the Calcutta industrial area.

The demands of these industries as well as of the large foreign, inland and coastal trade passing through Calcutta have naturally led to the existence of a large number of banking and insurance companies. Apart from the few indigenous concerns in these lines, quite a number of foreign banking and insurance companies, some of them having international reputation, have also opened their branches in the city. To meet other demands of trade and industry, specialized



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mechanisms like capital market and stock exchange, broking in various goods like jute and tea, wholesale, retail and commission business, clearing agencies and stevedoring and many others have also developed—all providing employment of various kinds not merely to the large population of the city proper but to thousands of "daily" passengers from the neighbouring small townships and villages. The city's transport system, the educational institutions, the learned societies, hotels and clubs, hospitals, and legal institutions all owe their present position to the commercial activities of the city. The pre-eminent position of the city has also been recognized by the special form of municipal government accorded to it and the creation of its own police department, separate from, though part of, the ordinary State service.

The importance of Calcutta as a commercial centre will be evident from three other factors, *e.g.*, (1) the number and tonnage of vessels entering and leaving the port during the last three years, (2) the volume of foreign and coastal trade handled by the port, and (3) the number and value of cheques cleared during this period through the Calcutta clearing house, as compared with the figures for the whole of India:

	1948-49		1949-50		1950-51	
	India	Calcutta	India	Calcutta	India	Calcutta
Vessels entered:						
Number ...	2,832	466	2,674	462	3,354	320
Tonnage ...	8,100,108	1,632,521	8,327,781	1,667,858	8,622,359	1,124,524
Vessels cleared:						
Number ...	2,926	616	2,782	627	3,096	511
Tonnage ...	6,723,451	2,203,412	6,694,719	2,267,678	7,714,433	1,822,996
Value of						
(*a*) Foreign Trade ...	9,66,23	4,36,60	10,45,71	4,25,28	11,52,34	4,00,47
(*b*) Coastal Trade ...	—	78,92	—	54,25	—	57,84
(in lakhs of rupees)						
Value of						
Cheques cleared (in lakhs of rupees)	6,686,51	2,655,26	6,197,92	2,356,18	6,577,59	2,386,37

Before Partition, Calcutta used to be the commercial capital also of the eastern districts of Bengal, and the trade of the entire undivided Bengal used to pass through Calcutta whose industries also depended, in their turn, largely on these districts either for the supply of raw materials or for the disposal of finished goods. With the establishment of Pakistan, this position has greatly changed and some part of the trade has been diverted to Chittagong. As, however, the last-named port is not yet in a position to handle the entire foreign trade of East Pakistan, the diversion has not so far been a complete one, and Calcutta still retains its pre-eminent position, even though in a slightly attenuated form.

Trade and industry in Calcutta is highly organized. There are as many as six Chambers of Commerce in the City representing all sections of trade, commerce and industry. The main functions of these Chambers are, among others, to promote and protect the trade, commerce and industries of the country and to watch over and protect commercial, industrial and financial interests of India and the interests of persons engaged in trade, commerce and industry in the country. Chambers also render useful services to the mercantile community by arbitrating disputes among members and issuing certificate of origin etc. All these Chambers are recognized by the Government and often consulted in the matter of formulation of commercial policies of the Government.

Some of these Chambers, particularly the Bengal Chamber of Commerce, the Bengal National Chamber of Commerce and the Indian Chamber of Commerce, have a large number of sectional organizations representing different trades and industry, affiliated with them, the respective Chambers undertaking the secretarial work of these associations. While the Chambers ordinarily confine their activities to matters of general commercial and industrial importance, the sectional organizations deal with the day-to-day problems of the particular trades or industries. Some of these organizations also perform a very useful function in respect of acquiring raw materials and distributing the same among their members. A few also have arrangements for researches into the various technical aspects of manufacture, and some of the more organized industrial associations have also their own labour welfare officers.

In the following pages, an attempt has been made to make a running survey of the principal industries of Calcutta and the subsidiary industries as well as the various allied trades. This survey is necessarily incomplete in the absence of full details and reliable statistics in respect of all the various lines of trades and industries. It will nevertheless give a rough idea of commercial activities of Calcutta

Jute Trade and Industry

The jute mills industry is the premier industry of Calcutta. There are 104 jute mills in India, all of them except a few being located in the Calcutta industrial area. The total number of looms installed at the end of 1948 was 65,800. The capital invested is over Rs. 50 crores, and the number of workers employed is more than three lakhs.

The industry occupies a very high place in the Indian economy, because of a number of factors. Apart from the capital invested and the number of workers employed directly in the industry, quite a number of industrial, commercial and financial concerns have grown round it, and a large number of persons in Calcutta earn their livelihood through the various allied trades. The industry also pays a large amount to Government revenue by way of taxes, duties and cesses, while the freight paid to the railways and steamer companies is also quite considerable.

It is, therefore, interesting to note that this industry depends greatly on foreign countries not merely for the disposal of its products, but for the supply of its raw materials. As regards the sale of jute goods, the proportion consumed within the country is quite insignificant compared to the volume of their exports.

In fact, up to 1949-50, jute goods had always topped the list of India's exports and it was only in 1950-51 that, for the first time, they had to yield the place of honour to cotton goods. Out of a total volume of exports of Rs. 471.94 crores in 1949-50, the share of jute goods was as much as Rs. 126.99 crores.

As for the raw materials, the dependence on foreign countries has been brought about by the Partition of the country in 1947. Till then, the undivided Bengal had practically a world monopoly in raw jute, comparatively very small quantities being produced in the neighbouring provinces of Assam, Bihar and Orissa. The jute mills in the Calcutta industrial area also had no difficulty in securing their necessary raw materials, leaving aside the question of occasional maladjustment between demand and supply. The proximity of the sources of raw material within the same political unit also placed the local mills in a position of great advantage over their rivals in Europe and America.

Partition has, however, greatly altered the situation, as more than 70 per cent of the total jute growing acreage and the aggregate production of raw jute has now fallen outside India, which has overnight been turned from a net exporter of raw jute to a net importer. Ordinarily, this would not have led to any difficulty as there are many instances of manufacturing industries in one country importing raw materials from elsewhere. Unfortunately, however, the circumstances in which India was divided and the bitterness which followed the Partition have made the supply of raw jute from Pakistan to the jute mills in India a political issue. Two Trade Agreements were entered into between the two countries, one in 1948 and the other in 1950, mainly with the object of ensuring a steady supply of raw jute, but the position does not seem to be very satisfactory even now. Apart from the uncertainty of securing the required quantity of raw jute, the divergent economic and financial policies of the two countries have also greatly complicated the matter. There is, for instance, the very high price which the mills have to pay for raw jute, primarily because of the refusal by Pakistan to devalue her currency.

The location of the larger portion of the jute growing areas in Pakistan has also affected the jute baling industry very adversely. Previously, particularly the entire export trade in raw jute was handled by the shippers in Calcutta, who used to press the materials which come mostly from East Bengal in the large number of hydraulic presses that had been set up in and around the city. In view, however, of the shortage of raw jute caused by Partition, and because also of the higher priority given by the Government of India to the requirements of the jute mills, restrictions were imposed by the latter on the export of Indian raw jute. The jute baling industry naturally stood in danger of a closure, but as the Chittagong Port has not yet reached a position such as would enable it to handle the export of all the surplus East Bengal crop remaining after a restricted supply to the Indian mills, Pakistan took advantage of an International Convention and began to export her raw jute surplus through the Calcutta Port. This process actually began in 1949-50, and it is remarkable that out of a total re-exports from India of foreign merchandise valued at Rs. 27.81 crores in 1950-51, as much as Rs. 22.20 crores accounted for the export of raw jute and that the entire trade was handled by the Calcutta Port. This incidentally has also saved the Calcutta jute presses from a total collapse.

It is clear that the position both of the jute mills and the jute baling industries would remain very much insecure so long as India continues to have a short supply of raw jute within her borders. Though, until Pakistan can set up an adequate number of mills, she will have to supply raw jute to the Indian industry, the only solid foundation for the latter would be to increase the acreage in India. Every effort is being made to make India self sufficient in this respect, but it will not obviously be possible to achieve this objective within a short time.

A large number of persons, otherwise than as workers in the mills, are engaged in the jute mills industry and the allied trades. There are first the jute dealers whose business is to "import" raw jute from the muffussil districts of West Bengal, Bihar, Orissa and Pakistan. Brokers act as intermediaries between these dealers and the mills. The products of the mills are exported to foreign countries by shippers who are linked with the mills through the agency of another set of brokers. During the last few years a large number of newcomers have entered the trade both as shippers of jute goods and brokers. Reference has already been made to the jute baling presses which are an important intermediary in the export trade in raw jute.

The mills also require a number of stores and mill accessories and a large trade has developed in the line. Some of these stores, particularly bobbins, are being manufactured on a small scale in Calcutta but they are for the most part imported from foreign countries. It is unfortunate that the jute mills industry has not extended its support to the indigenous bobbin industry which is, in consequence, languishing.

Jute mills also give a large custom to the engineering and paint industries, and to the banking and insurance companies, as well as to the steamer companies and railways.

The contribution of the jute mills industry to public revenue is also quite considerable. Special mention may be made of the export duty on jute goods. Taking advantage of India's monopoly in jute and virtual monopoly in jute goods, the Government of India had long ago imposed export duties on both. The rates were, however, kept sufficiently low so as not to discourage the export of jute and jute goods. Devaluation of the rupee in September 1949, however, changed the situation and the prices of jute goods in the U.S.A. became much higher than the internal prices in India, and in order to take advantage of the situation the Government of India have increased the rates of export duty, by two successive stages, from Rs. 80/- to Rs. 1,500/- per ton of hessian and from Rs. 50/- to Rs. 350/- per ton of sackings. These increases in the duties on jute goods have helped the finances of the Government considerably, as will be evident from the fact that while the export duties on jute goods yielded a revenue of Rs. 10 crores in 1949-50, the Government of India have budgeted for a revenue of Rs. 30 crores during the current year from this source.

The industry is highly organized. The Indian Jute Mills Association and the various other associations of dealers, balers and shippers are looking after the interests of all sections connected with the industry.

The Indian Central Jute Committee, set up by the Government of India, has its headquarters in Calcutta. Its functions are to watch over the interests of all branches of the trade from the field to the factory. The Committee has a Technological Research Institute at Tollygunge and an Agricultural Research Institute at Hooghly. The Indian Jute Mills Association Research Institute is also doing a very useful work in the field of research. The Institute of Jute Technology, recently started by the University of Calcutta in co-operation with Indian Jute Mills Association, is training junior officers of the mills in the various technical aspects of jute manufacture.

Tea Industry and Trade

The area under tea in India was little less than 7.75 lakhs of acres on March 31, 1949. Of these about 70% lies in Assam, and the districts of Darjeeling and Jalpaiguri in West Bengal. The rest of the acreage is spread over South India, U.P., Bihar and East Punjab. Before Partition, the tea estates in Sylhet and Chittagong (now in East Pakistan) had also formed part of the Indian tea industry.

The gardens in the North-Eastern India are being controlled mostly from Calcutta. These include even those which have their registered offices in the United Kingdom, as their management has been vested in the agency houses having their offices in Calcutta.

The total capital invested by joint stock companies in the tea industry of India and Pakistan during 1945-46 was estimated at over Rs. 50 crores. This does not include the capital invested by private owners, the amount of which is not, however, considered to be very large. Of the joint stock capital, Rs. 15 crores represented the investment of 476 Indian joint stock companies, the balance of about Rs. 35 crores being the capital of 169 companies incorporated in the U.K. and elsewhere*.

The number of workers employed by the tea estates both in India and Pakistan has been estimated at over a million and a quarter.*

The industry contributes a large sum to the Central and State Exchequers, through export and excise duties on tea, import duties on tea chests and other stores, income-tax and agricultural income-tax, land revenue and local cesses.

One of the major industries of India, the tea industry produces nearly 600 million lbs. of tea a year and accounts for more than Rs. 70 crores of exports. As an item of export, it occupies a place second in importance to jute goods. Unlike in the case of other industries, the export of tea is being regulated by an International Agreement which was first entered in 1933 by India, Ceylon and the then Netherlands East Indies, for meeting a very serious situation caused by the excess of world supply over world demand. The Agreement has since been renewed a number of times, and the contracting parties are now India, Pakistan, Ceylon and Indonesia. The basis of export, under the Agreement of 1950, is between 125% and 130% of standard exports fixed for each country.

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* Separate figures are not available for India only.

The very important position occupied by India in the world tea industry will be evident from the fact that out of a total of 808.43 million lbs. being the standard exports for the four participating countries, India has been allotted as much as 348.25 million lbs. On this basis, the Indian export allotment for 1950-51 has been fixed at 452 million lbs.

The task of regulating the export as well as restricting the production of tea has been vested by the Government of India in the Indian Tea Licensing Committee consisting of the representatives of the tea industry.

By far the larger proportion of Indian tea has to be sold outside India in competition with tea from other producing countries and also with other beverages like coffee etc. The need for adequate publicity was, therefore, long felt, and as early as 1903, the Government of India had imposed a cess on all tea exported from India with the object of utilizing the proceeds thereof for propaganda, mainly in foreign countries. The work was entrusted to an organization which was at the time called the Indian Tea Cess Committee. The Committee was subsequently re-organized and re-named as the Indian Tea Market Expansion Board. Lately, the work of this Board has been taken over by the Central Tea Board.

In the case both of regulation of export and propaganda for tea, there are two international organizations with headquarters at London for co-ordinating the work of all the producing countries. On both these organizations India is adequately represented.

As has already been mentioned, the tea estates of even those concerns which have their registered or agency offices in Calcutta are situated at a long distance from the city. Yet Calcutta is vitally interested in the welfare and the progress of the industry. Of the total exports valued at Rs. 78.09 crores in 1950-51, as much as Rs. 65.83 crores worth of Tea passed through the Calcutta Port, thus showing the close connection between this port and the prosperity of the industry.

It has also been estimated that the river steam companies and the railways receive about Rs. 2.5 crores as freight for carrying tea to the marketing centres and an equal amount for transporting stores and food stuffs to the tea estates.

Indian tea is marketed through three auction centres—one in London and the two others in Calcutta and Cochin in South India. Auction in London was first held in 1838 and has continued ever since with a break for about ten years following the outbreak of the last War. As the U.K. is by far the largest consumer of Indian tea and as London provides a central market for buyers in the European market, the industry considered it to be in its best interest to have the bulk of Indian tea crop auctioned in London. Even so, a portion of the crop is also being auctioned in Calcutta ever since 1841. There has recently been a strong demand for having the entire Indian tea auctioned in Calcutta, and it is likely that this would be possible in course of the next few years. Certain preliminary steps will, however, have to be taken before the entire Indian, or at least North-Eastern Indian, tea can be auctioned in Calcutta. Such measures cover the expansion of the existing facilities of the Calcutta port and the provision of adequate technical personnel.

Till recently, the auction in Calcutta was being conducted by four European broking firms. Two Indian firms have been admitted into the ring during the last two years. All these six firms form the Calcutta Brokers' Association and are also members, together with buyers and sellers, of the Calcutta Tea Traders Association which virtually controls the marketing of tea in India.

Some of the European firms have arrangements for training Indians in the technical operations connected with the marketing of tea, and the Ad hoc Committee on Tea, which was appointed sometime ago by the Government of India have in their recent report made certain recommendations for the grant of further facilities for the training of Indians.

The chief function of the brokers is to hold auctions of tea in Calcutta and Cochin and, in order to carry out this work satisfactorily, they perform some other functions also, such as sampling and inspecting, and tasting and valuing. Even before tea is sent to Calcutta for sale, master samples are sent in advance by the producers to the brokers for tasting and comments in order that any defects in the tea produced may be corrected before sale. Sampling and inspection of the tea to be sold are only a corollary to this preliminary test, while tasting and valuing are an important guide to the buyers at the time of auction.

The other most important function of the brokers is to make loans to the tea estates. Tea estates require both long and short term loans, the latter being advanced also by the managing agents of the companies and scheduled banks. As, however, it is not always possible for these two to meet the entire short-term financial requirements of the industry, any deficiency in this respect is partially made good by brokers, some of whom also lend against fixod assets for long periods.

Tea is sold in the market for consumption within the country by tea "blenders" and distributors, who obtain their requirements mainly from the auction, some portion being secured also directly from private forward contractors with producers. Roughly about 125 million lbs. of tea are marketed within India, the rest being available for export. One peculiar feature of the tea sold in the internal market is what is called the "blending" operation, *i.e.*, mixing the various grades of tea produced in different districts in certain scientific proportions in order to conform to certain standards popular to the different classes of consumers. As there is a great difference in the quality and appearance of tea produced in different gardens, this blending ensures a more or less unvarying standard in regard both to appearance and quality.

A large number of firms in Calcutta and Bombay are engaged in the internal trade of tea and all the connected operations.

Allied to the tea industry are the trades in fertilizers, tea-chests and tea-chest battens, tea chest linings and fittings and other stores. The principal fertilizers supplied to the tea industry are sulphate of ammonia and superphosphate, and also manure mixtures made up of these two ingredients as well as other organic compounds like bone meal, oil cakes, etc. Of these, sulphate of ammonia is at present chiefly imported from abroad, local production (about 70,000 tons annually) accounting for about a fourth of total requirements of the tea gardens and other consumers. It is hoped that the Sindri Fertilizer Factory, when in full production, will be able to meet the entire Indian requirements. As regards superphosphates, the local production is gradually rising and is quite sufficient to meet the entire requirements of the country. The other fertilizers are also available in plenty within the country.

It should, however, be mentioned that the tea industry consumes only a part of the fertilizers, whether produced within the country or imported.

There are about 11 firms in Calcutta which are at present engaged in the distribution of fertilizers.

Tea Chest and Battens Industry: As regards tea chest and tea chest battens, the requirements of the tea industry in India for packing materials were for quite a long time met by imports of tea chests and accessories from foreign countries, specially Finland and other Baltic countries. These chests, made from plywood shooks, proved to be much lighter than, and quite as strong as, the boxes made from indigenous solid planks of wood previously used by the industry. The two wars in the course of a quarter of a century, however, drew attention to the risk involved in depending on foreign sources for the supply of a very essential packing material, and an indigenous plywood tea chest industry has during the last few years been built up principally in and around Calcutta and some of the moffussil districts of West Bengal, Assam and South India. It is not necessary to refer to all the details of the progress of the industry during the last few years against heavy odds, but it would be sufficient to state that the indigenous industry has now come to stay.

The annual demand for tea chests has been estimated at about 6 million chests. Until about a year ago, there was not much restriction on the import of tea chests from abroad, and the indigenous industry had had to face unequal competition from the imported goods. The Government have, however, since revised their policy and have introduced a system according to which all importers of tea chests have also to buy indigenous tea chests in the proportion roughly of 1: 2.6.

Including 21, situated in and around Calcutta, there are about 32 factories in North India, manufacturing tea chests. All these factories manufacture good quality tea chests and have been included in the list of "approved" factories maintained by the Ministry of Commerce and Industry, Government of India. There are two categories of "approved factories"—"A" and "B"—according to the equipment of each factory. In addition, there are in Calcutta a number of cottage industry concerns whose products are not of course upto the standard laid down by the Ministry of Commerce and industry.

The factories situated in Assam and the Dooars secure their supply of suitable timber from the local forests. They are in this respect more fortunate than the Calcutta factories, which have no near source of supply of suitable types of timber. These factories depend for the supply of timber entirely on the Andamans. and the Government of India have made special arrangements for the supply of Andaman timber to the Calcutta factories. In view, however, of the inadequate transport facilities from the Islands, the factories have not so far been able to secure their entire requirements therefrom and are often faced with great difficulty on this account. The question of starting a veneer factory in the Andamans and transporting the veneers from the Islands to Calcutta is at present engaging the attention of the industry in consultation with the Forest Department of the Ministry of Agriculture, Government of India.

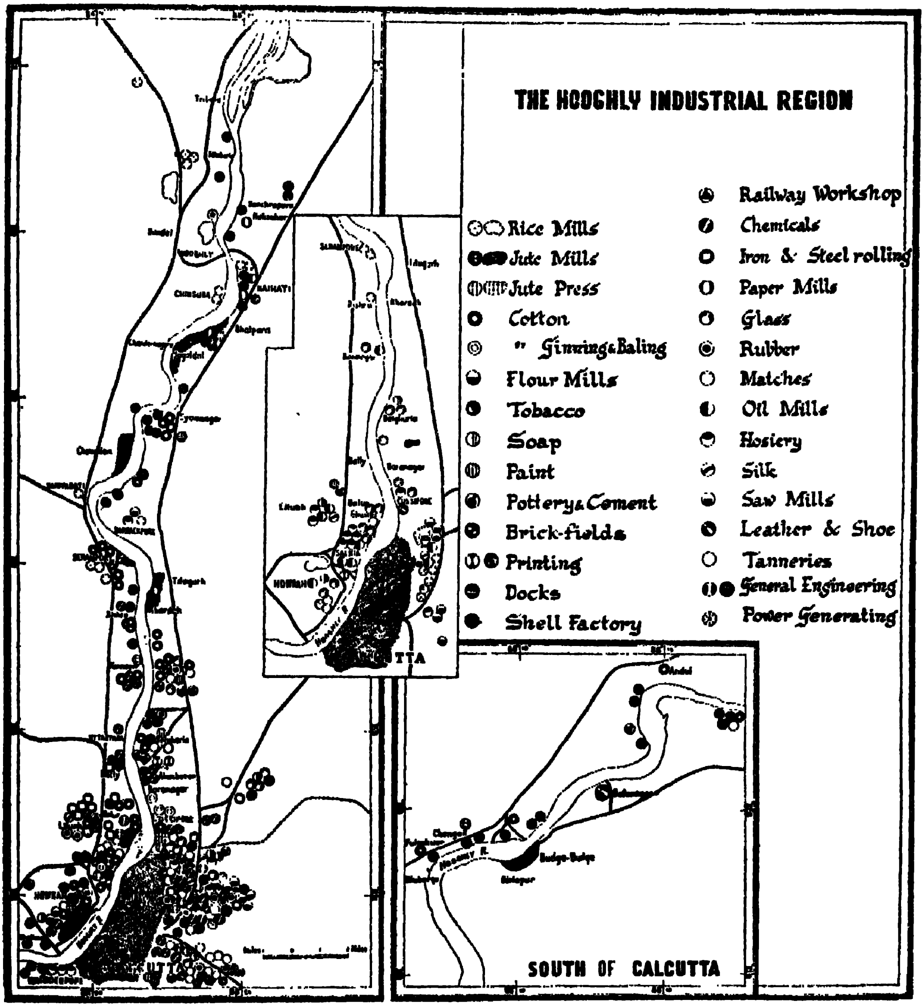
Both Calcutta and the moffussil factories are also experiencing considerable difficulties due to the lack of supply of casein at reasonable prices. Production of casein in India is not adequate for meeting the requirements of the plywood industry which has naturally to depend upon foreign sources of supply for the purpose. The price of casein has recently marked a very high increase and is adding to the cost of manufacture of the finished goods.

Side by side with the development of the indigenous industry large quantities of tea chests are also being imported from foreign countries, though on a restricted scale. During the current year, the Government of India have issued licences for the import of 2.2 million chests which, together with the carryover from the previous years and indigenous production, are expected to meet the total requirements of tea chests within the country. Previously, the entire import trade in tea chests was handled by the European agency houses in Calcutta. Recently, however, a large number of Indian firms have entered the trade.

The most important non-official organization that looks after the interests of the tea industry is the Indian Tea Association and the United Planters Association of South India. There are also a number of associations of other sectional interests. The I. T. A. is practically dominated by the European interests who own over 70% of the acreage under tea. Indian tea growers have their own organizations of which the Indian Tea Planters Association of Jalpaiguri is the most important. The various trades and industries connected with the tea industry also have their own sectional organizations, of which mention has already been made of the Calcutta Tea Brokers Association and the Calcutta Tea Traders Association. Among others, the most important are the Plywood Manufacturers Association of India and the Tea Chest and Plywood Trades Association.

Coal

As in the case of the tea industry, the main operative spheres of India's coal industry lie far away from the controlling centre. The coal fields are, for the most part, all situated in Bengal-Bihar border, though there are collieries also in Madhya Pradesh, Assam and Orissa. India's coal reserves have been estimated at 16,484 million tons, out of which as much as 15,498 million tons are in Bengal



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and Bihar. On March 31, 1947, there were 362 joint stock companies with a total paid up capital of Rs. 17.40 crores working all these collieries, besides quite a good number owned by the various railway administrations. The production of coal was 32 million tons in 1950. Most of the Bengal-Bihar collieries are managed by companies having their offices in Calcutta.

The coal industry is one of the basic industries of India. The development of all other industries as well as rail and steamer transport is absolutely dependent on the availability of coal in plenty at a comparatively cheap price. The principal market of Indian Coal is therefore, within the country, the more important consumers being the railways, the inland steamer companies, the users of bunker coal and the various industrial concerns, like the iron and steel works, cotton mills, jute mills, tea estates, paper mills etc. The domestic consumption of coal also is quite considerable.

While small quantities of coal have also been imported in some years, the maximum being 4.38 lakh tons in 1925, and some quantities have also been exported almost every year, coal is pre-eminently an item of internal trade. Nevertheless, it is important to note that the export of coal had amounted to as much as 1.2 million tons in 1920, since when, however, the volume of exports gradually came down on account of an embargo imposed by the Government of India on export. Prior to the imposition of this emargo, India used to supply coal to Straits Settlements, Ceylon and other Far Eastern countries. These markets were, however, all but lost as a result of this embargo, and it was not before 1935, that we could regain a small portion of the trade.

The Partition of India has also resulted in turning a part of what was prior to 1947 India's internal trade into India's export trade in coal. India's exports to other countries also have now reached a comparatively high level. During 1948-49, India exported, by sea, 1.13 million tons to all countries including Western Pakistan, the figure rising to 1.28 million tons next year. In 1950-51, however, the volume of exports came down to a little less than a million ton, owing mainly to the suspension of all exports to West Pakistan. These figures do not, however, take into account rail despatches to East Pakistan.

One remarkable point to be noted in this connection is that last year India also exported coal to England.

The question of the desirability of exporting Indian coal has long been debated having regard to the wasting nature of the reserves of coal. Practically the only variety of coal for which there is demand in foreign countries is the high-grade metallurgical coal, essential for the development of the iron and steel industry and it has been urged with considerable force that the export of such coal would not be in the ultimate interest of the country in view of the comparatively meagre reserves of such coal. Indeed, the need for the conservation of metallurgical coal has been admitted by all concerned. On the other hand, the present production of the high grade coal is much higher than the existing demand for the same, and as it will entail considerable financial and other difficulties in re-opening at a future date any mine that may be closed now, the Planning Commission has, in its Draft Report, recommended that, till such time as new demand is created and pending the adoption of other measures for conservation, the excess production of metallurgical coal should be exported to earn essential foreign exchange under special agreements to be negotiated with the importing countries. It is in pursuance of this policy that the Government of India are now permitting the export to foreign countries of coal irrespective of quality. Having regard, however, to the disparity between the prices of coal in India and Pakistan, the chief importing country, they have imposed an export duty of Rs. 11 per ton for all destinations.

A number of firms in Calcutta are engaged both in the internal distribution of coal and export to foreign countries.

Three organizations of producers of coal in India, two of them having their offices in Calcutta, control the production of coal in the country.

There are a number of bodies set up by the Government of India in Calcutta to handle the problems connected with coal. The most important among them are the Offices of the Coal Commissioner, the Chief Mining Engineer and the Indian Coal Grading Board.

Cotton Mill Industry and Trade

The cotton mill industry in West Bengal is concentrated mainly in the Calcutta industrial area, though Asansol which is rapidly growing into an industrial centre has one or two mills also. Before Partition, Narayanganj in Dacca was also an important centre of the cotton mill industry of undivided Bengal. The few mills there now fall outside the West Bengal industrial system, though almost all of them have their head offices located in Calcutta, as in the case of all the West Bengal mills.

The West Bengal cotton mill industry occupies the fourth place among the various regions of India in respect of looms installed, and the fifth place in regard to spindles. Bombay, including Ahmedabad, easily occupies the first place, other principal States being Madras, Uttar Pradesh, Madhya Bharat and Madhya Pradesh. In the industrial structure of West Bengal also, the cotton mill industry occupies a less important place than the jute mills industry, tea, coal, engineering etc. West Bengal has 3.76 lakhs of spindles and 7.7 thousands of looms installed, out of the all India total of 100.44 lakhs and 188.5 thousands respectively. The total number of mills is about 30 with a capital investment of about Rs. 4.50 crores, and an average production capacity of 170 million yards. The total number of workers employed is about 30,000.

Most of the cotton mills in the Calcutta industrial area are situated on the two opposite sides of the Hooghly, Serampore and round about on the west and Sodepur and the contiguous area on the east. The rest are situated in Garden Reach, Uluberiah and other places.

Compared with the demand for cotton goods in West Bengal, and also in the neighbouring States of Assam, Bihar, and Orissa, the size of the industry in this State is undoubtedly very small. Realizing the need for more balanced industrial development of the whole country, and having regard to the need for the production of more cotton goods to meet the increasing demand, the Government of India had, before Partition, decided to regulate the establishment of new cotton mills in the various parts of the country. Quotas of new looms and spindles to be installed in the then different provinces of India were accordingly fixed. These figures had, however, to be revised after Partition, and the final quotas allotted to West Bengal under the post-partition expansion scheme were 5,763 looms and 2,30,524 spindles. These were divided between existing and new mills, but unfortunately, only a small proportion of the quotas has so far been utilized.

West Bengal offers a number of special advantages to the development of the cotton textile industry. There is a large internal demand both within the State and the neighbouring areas. East Pakistan also offers a very near foreign market, while the facilities of the Calcutta Port would also enable any surplus quantity being exported to other foreign countries. Even otherwise, the port facilities are a great advantage in regard to the import of stores, machineries etc. The proximity of the coal fields is an added advantage. There are, on the other hand, a few handicaps suffered by the West Bengal industry, the most important of which is the distance of the sources of raw cotton which has to be transported to the Calcutta mills over a long distance. The African and the American raw cotton also have to be brought to Calcutta generally *via* Bombay, entailing heavy transport cost. The fact that American raw cotton cannot be imported direct to Calcutta is due to the absence of facilities for fumigation at the Calcutta Port.

These disadvantages do not, however, explain away the small size of the industry in West Bengal, compared to some of the other States in India. The fact, however, remains that most of the mills in West Bengal are uneconomic units, and that accounts for most of the difficulties of the industry here.

The existence of the cotton mill industry in Bengal has, nevertheless, led to the development of a number of prosperous trades in the various stores required by the industry. Apart from the machineries and machine parts, the mills require sizing and finishing materials and a variety of chemicals like dye-stuffs, bleaching materials, caustic soda etc. These trades give employment to a large number of workers.

Calcutta has always been one of the principal centres of distribution, both wholesale and retail, of cotton goods. Even before the Indian cotton textile industry attained its present position, Calcutta was the principal port through which foreign textiles, particularly those from Lancashire, used to be imported for distribution in the Northern Indian markets. It retained its pre-eminent position in the field, even after the attainment by the indigenous industry of its present stage of development. The introduction of the present system of control over distribution has, however, deprived Calcutta of the wholesale and distributive trade with other States. The Partition also has deprived it of some of its importance, as the requirements of East Pakistan have no longer to be handled by the Calcutta merchants. Even so, the cloth trade occupies a very important position in the economy of the State.

The present system of distribution of cloth in West Bengal, as in other States, is through an elaborate machinery of nominated buyers, approved wholesalers and approved retailers in respect of the controlled sector of the goods manufactured by the mills all over India. According to the present regulations laid down by the Government of India, mills are free to sell 20 per cent. of their manufactures to whomsoever they may please subject to the exercise of price control at all stages of distribution. The remaining 80 per cent. of the products are, however, subject to full distribution control. There are about 30 firms of nominated buyers appointed by the State Government whose business is to lift the goods of the mills, allotted to West Bengal by the Textile Commissioner, and bring them down to Calcutta on payment of the ex-mill prices to the mills and other charges to the Government and also the transport cost. The products of the West Bengal mills are generally allotted entirely to West Bengal and are also lifted by the nominated buyers. The goods are then passed over to the approved retail shops through the intermediary agency of approved wholesalers.

The approved wholesalers number about 70, while there are about 500 approved retail shops in Calcutta. A good proportion of these retailers sell only *dhuties* and *saris* but, as supply of millmade goods is at present greatly restricted, the establishments have to maintain themselves as economic units by dealing also in handloom goods. A comparatively small number of the retail shops is also represented by tailoring establishments who obtain from the control system only yardage cloth and supply ready-made and made-to-order garments to their customers. Apart from catering to the requirements of the civilian population, some of these tailoring establishments have also the various Government and semi-Government establishments and commercial firms as their standing customers, supplying them with uniform and liveries for bearers and menial servants. A fairly large number of professional tailors and cutters are engaged by these tailoring establishments.

Control over production of cotton-mills products in West Bengal is exercised by the Textile Commissioner, Government of India through the Regional Deputy Director of Production, stationed in Calcutta, while the Textile Directorate of the West Bengal Government exercises control over distribution.

Hosiery Industry: Allied to the cotton mills industry are a number of industries which have made some progress in West Bengal. Chief among them is the hosiery industry which has developed in West Bengal to a much larger extent than in other parts of India. A substantial proportion of the total production of hosiery goods in undivided Bengal has fallen to East Pakistan, but the majority of those factories, now in West Bengal, is located in and around Calcutta.

The installed capacity of the industry is more than enough to meet the requirements of West Bengal and has often met the demands from other parts of India. Unfortunately for the industry, its raw material, hosiery yarn, is not manufactured in any but small quantity by the West Bengal cotton mills, the principal source being the Madura group of spinning mills in the South, which has been supplying practically the entire requirements of the industry for quite a long time. As a larger number of hosiery factories has meanwhile been started in other States, the West Bengal Industry is not able to secure even a fair proportion of its requirements of yarn and is consequently experiencing considerable hardships

Cotton Textile Machinery: In dealing with the cotton mill industry in West Bengal, reference should appropriately be made to the manufacture of machinery and machinery parts of all kinds, particularly those required by the cotton textile industry in respect of which some progress has been made in Calcutta. Apart from the Textile Machinery Corporation Ltd. which owns and operates a factory at Belghurria on the east of the Hooghly for the manufacture of complete textile machineries, there are other factories also which manufacture machine parts. Chief among these is the India Machinery Co. Ltd. which has its factory at Dasnagar, Howrah.

Belting Industry: The Indian belting industry, an important branch of the cotton-mill industry is entirely located in the Calcutta industrial area. There are four manufacturers of belting whose combined installed capacity is more than enough to meet the full requirements of India as a whole. Apart, however, from the fact that imports of belting from foreign countries are still continuing, the industry also suffers fròm an irregular supply of hair yarn which is mostly imported from abroad.

Fabrication of readymade garments for the purpose of export overseas is also an important industry of Calcutta. Till recently this industry was located entirely in the city, a few Calcutta firms, who had developed the trade for about 100 years or so, enjoying practically a monopoly in the business. The recent control measures of the Government, however, have seriously affected this industry and Calcutta fabricators are on the point of losing the trade due to the difficulty in securing adequate quantities of suitable cloth for being processed into readymade garments.

The non-official organization that looks after the interest of the Cotton-Mills Industry in West Bengal is the Bengal Millowners Association. The nominated buyers, the approved wholesalers and the retailers have each their own organizations performing very useful functions in the distribution of goods and maintaining control over the whole system.

The hosiery industry also is well served by the Bengal Hosiery Manufacturers Association, while the belting industry also has organized itself in the Indigenous Belting Manufacturers Association.

Engineering Industry

The engineering industry is one of the leading industries of Calcutta. The most important steel works of India are of course outside the Calcutta industrial area, but their proximity to Calcutta, which also contains a number of re-rolling factories where steel is manufactured from scrap irons, has ensured a steady supply of the basic material for the industry. The facilities for the import of foreign steel through the Calcutta Port have also been an important factor in this respect. On the other hand, the large number of various categories of industrial concerns not merely in the Calcutta industrial area, but in the entire North-Eastern India, always provide a ready customer for all kinds of fabricated goods.

Almost all industrial concerns in Calcutta have their own workshops where petty repairs are done and sometimes simple machinery parts are also manufactured. These workshops are not, however, in a position to meet the entire requirements of the parent factories, which have necessarily to depend on outside workshops for the purpose. A large number of purely engineering workshops has thus been established mostly in Howrah. These supply a very large proportion of the demand for the various kinds of accessories required by the industrial concerns. Most of these workshops are small-sized, and standing head and shoulder over them are the large engineering works, smaller in number but possessing the most up-to-date machineries and equipment and employing highly skilled engineers, foremen and workers.

The total number of general engineering and electrical engineering factories registered in West Bengal was 467 in 1947 out of an all India total of 1,206. The number of persons employed, either directly or through contractors, was 57,063, and the total value of products made for sale and of work done for customers was valued at Rs. 16.53 crores. The corresponding all India figures were 1,22,127 and Rs. 34.27 crores respectively.

The manufacture of machineries has not made much progress in India, but quite a good start has been made in respect of machine tools, machine parts, chemical plants, galvanized pans and cisterns, motors, fans, switch gears, bolts, nuts, rivets, etc. Among other goods manufactured in Calcutta are weighbridges, printing machines, wire products, etc. There are a number of firms specializing in structural engineering and in the manufacture and fabrication of bridges, while the dock yards at Garden Reach and Shalimar, the railway workshops at Lilooah, and a few private engineering works perform very useful services in repairing ships, both sea-going and riverine, building boats and small vessels, and wagons and coaches. The city and suburban transport system also gets the bodies of tram cars, buses and trucks built by various engineering factories in Calcutta. A beginning has also been made for manufacturing complete motor cars, and assembling parts thereof, as well as complete cycles and parts.

Among the subsidiary industries dependent on the iron and steel industry, special mention should be made of the enamel, lantern, galvanizing, sheet metals, fans, steel boxes and almirahs, etc. Calcutta is the principal centre of the manufacture of enamel wares and sign boards and an important centre in respect of lanterns, steel boxes and almirahs, fans, sheet metals and containers of various sizes and shapes. There are also a number of foundries.

There is a large trade in iron and steel goods, both indigenous and foreign, passing through Calcutta. The two principal manufacturers of steel in India have their principal sales offices in Calcutta, while the stockists and distributors of both tested and untested steel carry on their trade through a large number of dealers. Of the imported goods, the most important are manufactures of iron and steel goods, like wire nails, nuts and bolts, door hinges, etc., imported both from England and the Continent.

Chemicals, Paints and Soap

Calcutta had remained for quite a long time the home of the Indian chemical industry. Laterly a number of factories have been started in other parts of India also, but Calcutta still retains its leading position in the industry. Out of Rs. 15.74 crores being the total capital employed in the industry all over India in 1947, West Bengal's share was as much as Rs. 5.42 crores. The total number of workers employed by the West Bengal factories was 12,830, compared to the all India total of 32,250. In respect of the value of products and by-products of the industry also, West Bengal predominated, the local factories accounting for as much as Rs. 7.31 crores out of the all India total of Rs. 17.46 crores. These figures also cover such allied industries as toilets and cosmetics, and paints. As regards the purely chemical factories including pharmaceuticals, the total capital invested in West Bengal at present has been estimated at Rs. 2.75 crores and the workers employed at 12,277.

The major products of the industry include sulphuric acid, nitric acid, caustic soda, soda ash, fertilizers, aluminium compounds, alums, coal tar and coal tar products, gases, disinfectants and insecticides, etc. An important branch of the industry is engaged in the manufacture of drugs and pharmaceuticals of various kinds such as quinine, tinctures and galenicals, proprietory medicines, injectules, etc. Yet another branch of the industry, mostly concentrated in West Bengal, manufactures cosmetics and toilet preparations, such as powder, snow, hair-oils, hair-lotions, tooth powder and tooth paste.

In respect of many articles, the industry has become self-sufficient, though production lags behind consumption in regard to many others. On the other hand, the industry depends in varying degrees on foreign countries for the supply of some of the basic materials.

The manufacture of heavy chemicals like sulphuric acid, caustic soda, soda ash, etc. mostly fostered as a result of the impetus given by the last War is making considerable progress and is expected to help in the development of other subsidiary industries. As yet, India is deficient in regard to the supply of those basic chemicals. The Korean War and the subsequent re-armament drive in America, England and other countries have considerably affected the production of sulphuric acid, as India has to depend largely on imports from America for the supply of sulphur.

The industry is very well served by the Indian Chemical Manufacturers Association.

Paint Industry: Allied to the chemical industry is the paint industry of which there are about 28 factories in the Calcutta industrial area. The industry is practically confined to West Bengal, production in other parts of India being negligible, compared to that of West Bengal factories. The principal products of the industry includes oil paints, and enamel, oil and synthetic lacquers. In 1947, the West Bengal factories had produced paints valued at Rs. 69.56 lakhs out of the all India total of Rs. 73.56 lakhs. The chief raw materials of the industry are linseed oil (of which there is ample supply in the country) and the various chemicals like lithophone, lead and zinc pigments, red oxide, etc. most of which are imported from foreign countries.

Soap Industry: The Indian soap industry was first started, though on a cottage scale, in Bengal during the Swadeshi days of 1905. Calcutta remained for quite a long time the principal centre of the industry. Unfortunately, however, except for a very few, almost all the soap factories in and around Calcutta are now passing through a crisis mostly because of the loss of the East Pakistan market on which most of the Calcutta factories largely depended for the disposal of their finished goods. This loss would not have mattered much if, meanwhile, alternative markets could have been developed. Unfortunately for the larger number of factories, this has not been possible.

A further reason why the Calcutta factories are not doing well at the present moment is their small financial resources which, together with the loss of market, have exposed them to unequal competition from other more resourceful factories

Even so, there are a few factories, including one owned by non-Indians, which are manufacturing quality soaps having markets even outside West Bengal. Some of them are even exporting their goods to foreign countries.

Apart from the peculiar difficulties referred to above, which are being experienced by the West Bengal factories, the Indian soap industry as a whole is also suffering from a number of handicaps, the most important of which is the supply in adequate quantities and reasonable prices of coconut and other vegetable oils, the chief ingredient of the finished goods. Production in 1950 dropped to about 70,000 tons, which is about 25% of the installed capacity. The short supply of caustic soda and aromatic and essential oils is another factor which is causing great difficulty.

The Indian Central Coconut Committee, set up by the Government of India some time back, are at present engaged in exploring the possibilities of developing the plantation of coconut trees in various parts of India, including West Bengal. It will, however, take some time, before these efforts yield any fruits and, till then, the Indian soap industry will have to depend largely on the uncertain prospects of securing adequate imports of coconut oil from foreign countries.

The deficiency in the supply of caustic soda is, however, likely to be met to a large extent in near future by the local manufacture within the country, in respect of which a steady progress is being made.

The Indian Soap and Toiletries Makers Association is looking after the interest of the soap industry and also of the manufacturers of cosmetics and toilet products.

Glass, Electric Lamps and Ceramics

Calcutta is one of the most important centres of the Indian glass industry. In fact, some of the earliest glass factories of India were started in this city and a few of them are now among the leading manufacturers of glass in the country.

There are 34 factories in Calcutta engaged in the manufacture of glass-wares. The total capital invested would be of the order of Rs. 55 lakhs with about 8,000 workers.

The West Bengal glass industry, which is mainly located in the Calcutta industrial area manufactures the following items of glass goods: bottleware, tableware, lampware, pressed ware, scientific glass ware and electric lamp shells. One factory in Calcutta was also till recently engaged in the manufacture of sheet glass, but producton has of late been suspended pending the installation of new up-to-date plants in the place of the existing ones.

The problems of the Indian glass industry are the difficulty in securing adequate supplies of raw materials such as soda ash and other chemicals, and sand. Previously, the industry had to obtain its entire requirements of soda ash from foreign countries, and its claim to tariff protection had been turned down in 1934 on the ground of its dependence on foreign sources for the supply of the basic material. The Government had, however, given some relief to the industry at the time in the shape of a refund of the customs duty on imported soda ash. This relief which was highly valued by the industry has since been withdrawn in order to encourage production within the country of soda ash, in respect of which considerable progress has recently been made. As, however, the indigenous soda ash is lighter in weight and the heavier variety is more suitable for the manufacture of glass goods, and as, further, the local production can meet only about 30 per cent of the requirements of the industry, it is still largely dependent on soda ash imported from abroad.

The West Bengal industry generally gets its supply of sand from the Allahabad district. Apart from the fact that this sand contains many impurities, the transport charges to the Calcutta factories are often considered to be rather high.

The supply of coal to the industry is also not satisfactory, despite the proximity of the mines. This has often held up production unnecessarily.

The loss of the East Pakistan market has imposed a heavy strain on the Calcutta glass factories, most of which have not yet been able to find out alternative markets.

The Western Bengal industry is very well organized and the Bengal Glass Manufacturers Association has been rendering useful services to the industry. This Association is affiliated to the All-India Glass Manufacturers' Federation, the central body of the Indian glass industry.

The location of the Central Glass and Ceramic Research Institute at Jadavpur has also been of great assistance to the West Bengal industry due to its proximity to the local factories.

Electric Lamp Industry: Allied to the glass industry is the electric lamp industry. The manufacture of electric lamp shells is indeed a part of glass manufacture, but as the cost of production of lamp shells is very low compared with the total cost of manufacture of electric lamps, the electric lamp industry has always been regarded as the separate industry.

The importance of Calcutta as a centre of the electric lamp industry will be evident from the fact that the six factories in Calcutta out of about thirteen Indian factories have an annual rated capacity of 15 millions out of an all India total of 23 millions and that their production in 1950 was about 10 millions out of a total all India production of about 14 millions. The total capital invested by the Calcutta factories has been estimated at about Rs. 75 lakhs.

The main difficulty which the industry has been exprienciing is the slow rate at which consumption is increasing. The various electricity projects which were expected to be put into execution by this time have been slowed down in many cases, and the building programmes have been seriously affected for want of materials. Partition has also considerably reduced the over-all consumption previously estimated for undivided India. The industry, on the other hand, was encouraged a few years ago to expand its installed capacity having regard to the probable increase in internal demand. As a result of this expansion programme, the installed capacity of the industry as a whole is likely to reach 32 million lamps in 1952, as against an anticipated internal demand of only 19 millions.

Difficulties are also being experienced in respect of securing essential raw materials such as brass caps, steel mandril wire, molybdenum wires etc. from foreign countries. The irregular supply of these articles has affected production to a large extent.

The Indian Lamp Factories Association is rendering very useful service to the industry.

Ceramics: There were in 1947 eighteen ceramic factories in West Bengal out of the all India total of 52. The importance of West Bengal as a centre of the ceramics industry will be evident from the fact that the total productive capital employed in West Bengal was Rs. 1.12 crores as against little less than Rs. 2 crores being the all India figures. The number of workers employed was 6,814 out of the all India total 13,694.

The products manufactured by the industry include domestic ware, electric insulators, sanitary equipments and fittings, pipe, refractories, tiles, earthen and stone ware for chemicals, and jars. The basic materials used are china clay, fire clay, pipe clay and red clay, quartz, magnesite, gypsum, etc. Few of these raw materials are available within West Bengal and some of them have to be imported from other countries also.

Food Industries and Trades

On the food industries of West Bengal, the most important are the rice and flour mills. Previously, a substantial portion of the requirements of Calcutta in respect of rice, flour, atta and bread were met by these mills which used to secure paddy and wheat from the market on their own intiative. The production had of course had to be supplemented from imports either from other parts of India or even occasionally from foreign countries. The present food crisis in the country and the introduction of control over movement of foodgrains and the milling of paddy and wheat as well as of the rationing system have largely affected this position.

For some time, the Government have been supplying whole wheat as part of ration to the people of Calcutta, and a large number of *chakis* have been started in various parts of the city for converting the wheat, thus distributed, into atta. The flour mills are nevertheless kept busy for milling wheat (supplied to them by the Government) into flour for being used in the bakeries and biscuit factories, of which there are quite a large number in Calcutta.

There are about 80 rice mills in the Calcutta industrial area, and a further 150 in the moffussil districts. The Calcutta rice mills have to depend for the supply of their paddy entirely on the Government, and their position naturally depends upon the degrees of success of the procurement programme of the latter. The moffussil mills, however, are permitted to supplement their supply from Government procurement by independent purchase, and are, therefore, more fortunately placed than the Calcutta rice mills which have, for varying periods in the year, to keep idle for want of paddy. In fact, a majority of the mills in the Calcutta area are running at a loss being unable to run as economic units.

Prior to the introduction of Control, the Calcutta rice mills used to supply the major requirements of the city population. It is, however, very difficult to state precisely as to where and how their products are now disposed of by the Government who take over the entire production from the mills. The rationing system in Calcutta is being administered by the Food Department through the agency of a number of appointed wholesalers and a net-work of ration shops, of which a fair proportion is owned and managed by the Government.

The oil mills in and around Calcutta crush all varieties of seeds, particularly mustard seeds and linseeds and to some extent also groundnuts. In respect of none of these seeds, West Bengal has an ample supply and large quantities of seeds have to transported from other parts of India, particularly the U. P. in the case of mustard seed, while good quantities of mustard oil is also imported into West Bengal from the U. P. The Calcutta oil mills have also lost an important market in East Pakistan.

In recent years, vanaspati industry has made considerable progress in India, and Calcutta has as many as 8 factories in the line. Most of these factories produce vanaspati for human consumption, while one or two also supply industrial hydrogenated oil largely for use in the soap industry. The main raw material of the industry, *viz.*, groundnut oil, is mostly imported from other parts of India, the local production being much too low for the requirements of the industry.

Generally speaking, West Bengal is deficient in the supply of food articles and there is a very large trade in Calcutta for the import of sugar, salt, pulses, mustard oil, ghee, vegetables and other food articles. Small quantities of "Dal" seeds are also imported by a few Dal mills, but their production is quite insignificant compared to the total requirements. Paddy, rice, wheat and wheat products are also imported on a large scale, but the trade in these articles is in the hands of the State.

Paper Industry and allied Trade

As in the case of many other industries, the Indian paper industry is being managed and controlled by the head offices of the various mills in Calcutta. The share of the West Bengal mills is as much as 50% of the total Indian production, that of those situated in the Calcutta industrial area being about 40%. The total all India production, estimated at little more than a lakh tons in 1947, has since marked some decrease, but the importance of Calcutta as a centre of paper manufacture still remains unchallenged. The West Bengal mills are situated in Titaghur, Kankinara, Halisahar—all in the Calcutta industrial area—and Raniganj. The other mills are in Bihar, Orissa, U. P. and East Punjab.

The products of the paper mills are broadly classified into three categories—printing, writing and wrapping. The Calcutta mills manufacture all those varieties, some of them producing qualities comparable in quality and price to similar varieties imported from foreign countres. In fact, quality for quality, Indian paper is the cheapest in the world at the present moment.

The raw materials used are, principally, bamboo pulp, and sabai grass. The chief sources of supply are East Pakistan, Assam and Orissa, most of the mills having plants for manufacturing pulp out of bamboo as an intermediate stage.

There is admittedly a shortage of paper in India, and large quantities of all varieties are imported from foreign countries to supplement local production. A large trade has naturally developed for handling the goods, both imported and indigenous. As a centre of import trade, Calcutta undoubtedly yields place to Bombay, but its share in the imports is nevertheless quite substantial, while it has a lead over other centres in respect of the indigenous goods. There are about 150 firms in Calcutta engaged in the import, distribution, wholesale and retail trade. Their position has indeed been largely affected by two factors: large quantities being directly acquired by the Government from the paper mills, and the loss of the East Pakistan market. Nevertheless the Calcutta traders still perform a useful function in catering to the civilian markets not merely of West Bengal, but also of Assam, Bihar, Orissa, U.P., Madras and even of Burma.

Allied to the paper industry are two subsidiary industries—the manufacture of boards and of stationeries. There are about 5 or 6 firms in Calcutta which manufacture boards from waste paper and rags. The industry is thriving and has a great future. There are also an equal number of fairly big-sized and a few smaller manufacturers of stationeries, such as exercise books, invitation cards, envelopes, letter pads and account books.

Of all the varieties of paper imported into India, newsprints top the list. The principal consumers are the various newspapers, while small quantities are also used for printing Panjikas, cheaper catalogues and primary text books. Of all the centres of India, Calcutta has perhaps the largest number of newspapers, published in various languages; English, Bengali, Hindi and Urdu.

The number of printing presses is also quite considerable. Most of these have quite up-to-date composing and printing machines and are quality printers. There are printing presses in Calcutta having facilities for printing in almost all the languages of the world. A few have also arrangements for printing in multi-colours.

There are two Associations of manufacturers of paper in Calcutta—Indian Paper Makers Association and Indian Paper Mills Association. The trade is also organized in the Calcutta Paper Traders Association. Other sections also have their respective organizations.

Miscellaneous Industries and Trades

In the foregoing pages, an attempt has been made to review some of the principal industries and trade of Calcutta. The limitation of space does not permit the detailed review of many other industries and trades, some of which are no less important than a few mentioned earlier.

Among these mention should be made of the industries manufacturing non-ferrous articles, motor vehicles, sewing machines, electric brass lamp holders, pencils, fountain pens and ink etc.

1. **LABORATORY GLASSWARE.** For teaching and Research purposes, all table blown and graduated like Burettes. Pipettes, Flasks, Soxhlet Apparatus, Separating Funnels, Gas Measuring Apparatus, both in soft glass and Pyrex, Jena or Hysil.

2. **LABORATORY HARDWARE AND FURNISHING,** like Water Taps, Gas Taps, Burners, Gas Plants, Sinks, Stands iron and wooden all types.

3. **ANALYTICAL & TESTING EQUIPMENT,** like Analytical Balances, Weight boxes, Filter Pumps, Pressure and Vacuum Pumps, Hot Plates, Soil Analysis Apparatus, Dairy Equipment, etc.

4. **INSTRUMENTS FOR TEACHING & DEMONSTRATION.** A vast range for Physics, Chemistry, Zoology, Botany, Geography, and nature study.

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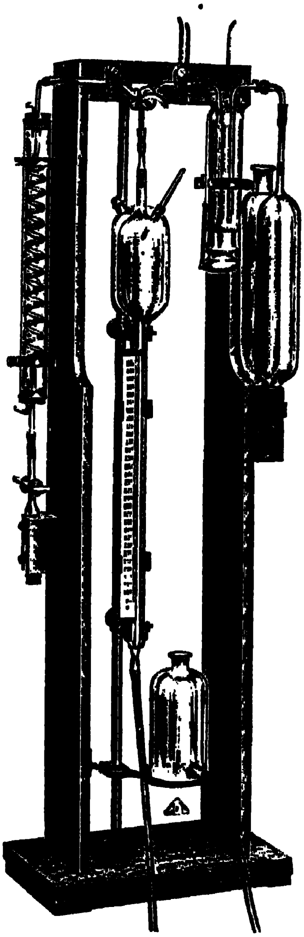

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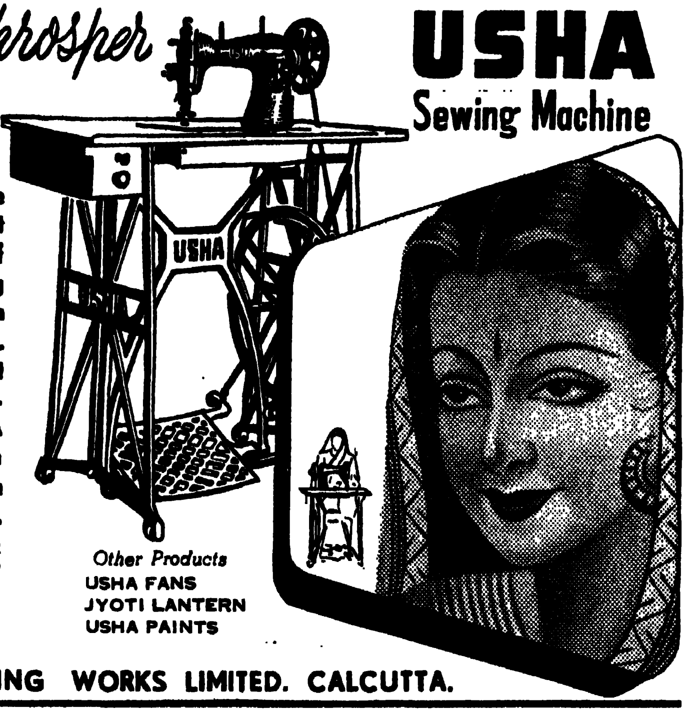

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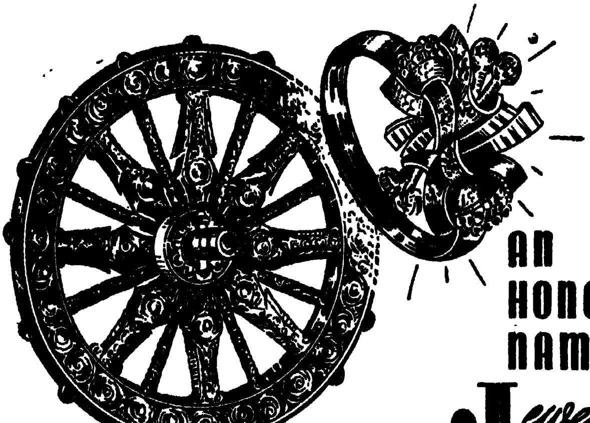

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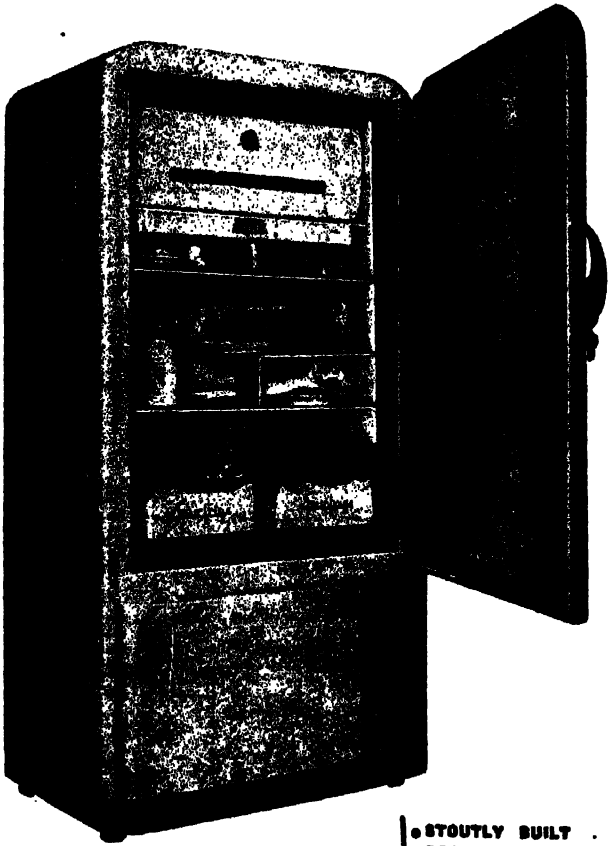

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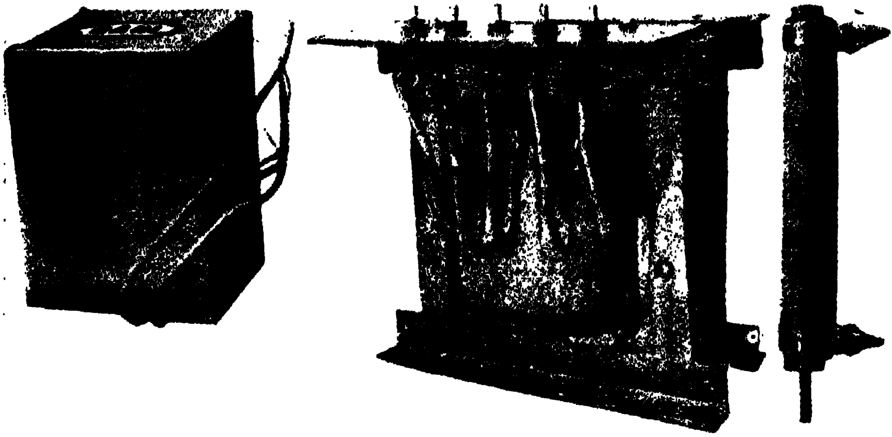

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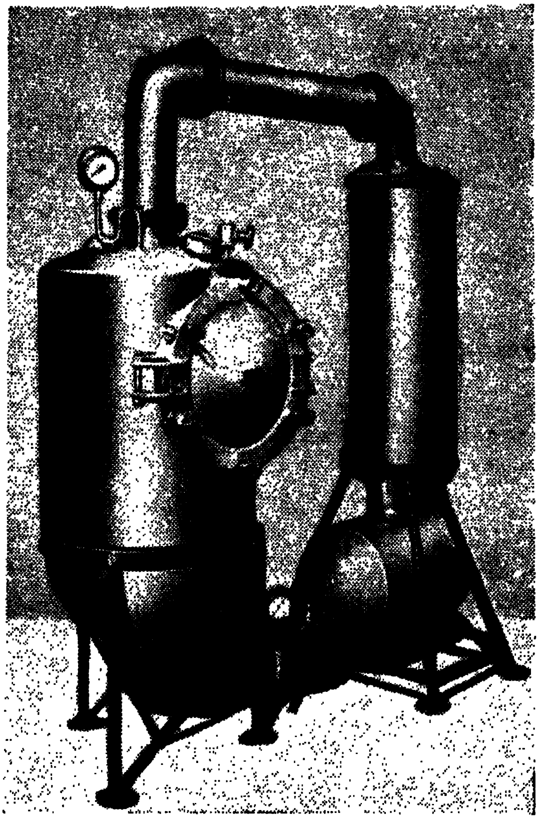

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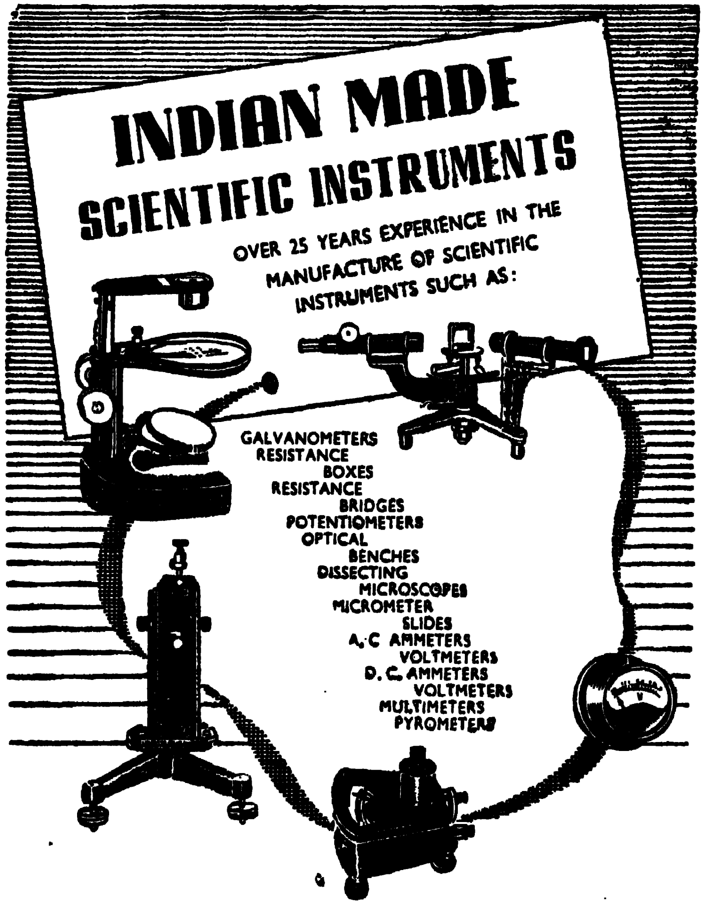

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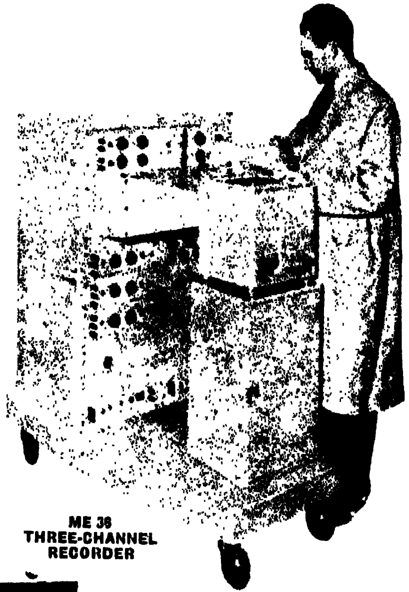

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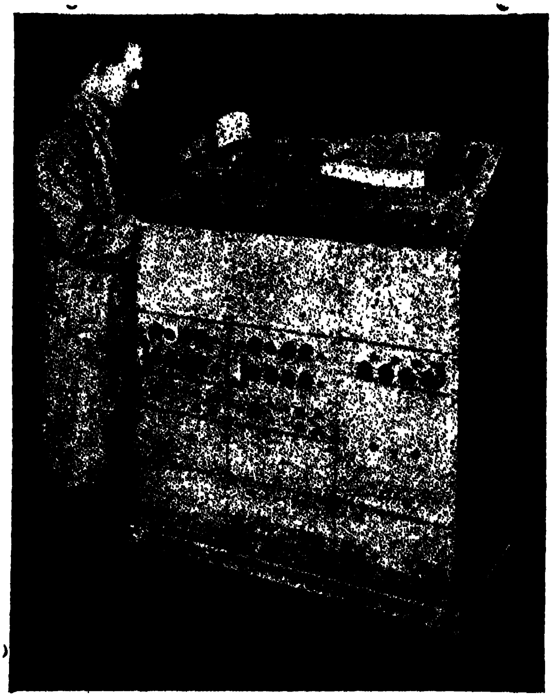

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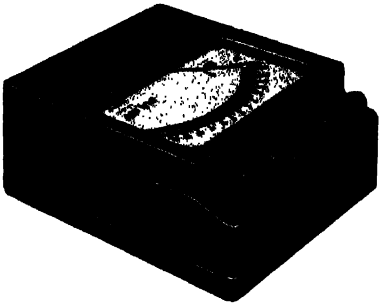

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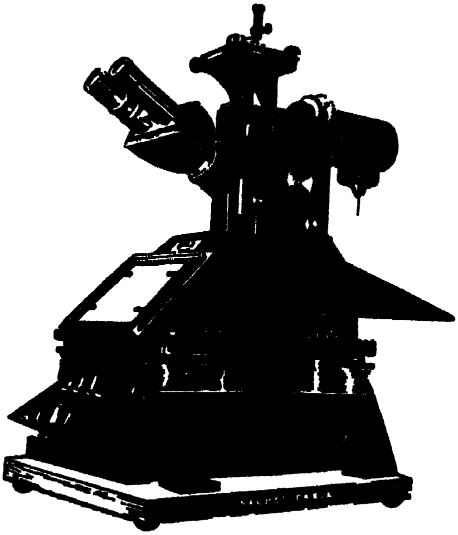

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